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CLASSROOM TECHNOLOGY

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MINISTRY OF EDUCATION

CURRICULUM DEVELOPMENT

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TECHNOLOGY

Music

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Music

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with
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edited by
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Provincial Educational Media Centre
Resources Branch
Ministry of Education
Province of British Columbia

Canadian Cataloguing in Publication Data
Fairholm, Brian.
Classroom technology, music

Includes bibliographical references.
ISBN 0-7726-1065-7

1. Music - Computer-assisted instruction. 2. Music - Instruction and study - British Columbia. I. Anderson, Allan. II. Moran, Mary. III. British Columbia. Ministry of Education. Resources Branch.

ML74.F34 1990 372.87'044'09711 C90-092039-4

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Preface

The rapid development of technology during the last decade has had a tremendous influence on the world of music and music education. Personal computers and synthesizers have extended the possibilities of how music is created, performed, recorded, and taught. In contemporary pop culture, such as the film and music industries, soundtracks and compact disks are constantly reflecting the most recent technology. Computers enable composers to experiment with sound in new ways, and to develop innovative approaches to composition.

One functions of music education is to communicate and make accessible the body of music that is part of western and non-western cultures. Another important function of music education is to lead the way to the future, to be aware of and part of the current frontier in music. The purpose of this publication is to give educators an overview of current technology and its application within the music curriculum.

Trying to summarize current technology is a bit like trying to paint a child's portrait - it would be a lot easier if the subject would just stop moving. Everything to do with music technology is changing so rapidly that I hesitate to use the word *current*. Software developers are learning from each other and include so many new features with each upgrade that the "best sequencer on the market" changes every few weeks. Music hardware is developing just as rapidly. We have deliberately stayed away from attempting to review specific instruments because the usefulness of such a review would be short-lived. The product descriptions and suggestions provided in this publication are intended to help define the broad categories of equipment and software. We hope that the material included here will help educators identify ways in which computers and technology can be used in their own music programs.

We have benefited from the experience of a number of music educators who have pioneered the use of technology in their programs. Dallas Hinton and Allan Anderson have been using computers within their programs for several years and have given workshops in many districts throughout British Columbia. Their contributions to this project, both written and verbal, are greatly appreciated. Rob Turner and Marty Summers, who have more recently included computers within their music programs, contributed a number of software evaluations. I have appreciated their expertise and enthusiasm.

I am grateful to Mary Moran, the editor of *Classroom Technology: Music* for the initial idea of the project and her guidance, not to mention hard work, through the steps in its publication. I am also grateful to Rick Withers and Tim Winkelmans for their contributions to the project.

Brian Fairholm

Utilization Overview

Computers and current music technology are being used:

- ***to help students and teachers compose and arrange music,***
- ***to provide accompaniment for rehearsals and performances,***
- ***to allow students to explore and experiment with sound and to compose,***
- ***to assist in music instruction and training, and***
- ***to help perform a variety of administrative tasks.***

Composition and Arranging:

Composition is an area of the music curriculum that has been a challenge for most teachers to implement using traditional tools and approaches. The process of notating ideas with pencil and manuscript, hearing them performed, and then developing and revising them, has been too slow and problematic to be practical in most classroom situations. Computers, however, can provide tools which greatly assist in this process.

The ease with which musical data can be entered and played back, edited, manipulated, and stored, can help students articulate and develop musical ideas. The computer can assist in every stage from the initial experimentation to printing out parts and recording. The availability of low cost synthesizers with professional quality sound enables students to create high quality recordings of their compositions and arrangements.

Software used for music composition and arranging most commonly falls into three categories; sequencing, notation/transcription, and algorithmic composition.

Sequencers:

Sequencers are programs which record and playback MIDI (Musical Information Digital Interface) data. The most common metaphor used in sequencing software is the tape recorder. The user can record sequences or tracks of MIDI data from a keyboard, or other MIDI controller. Familiar tape recorder controls such as Play, Record, Fast Forward, and Rewind are commonly used in sequencers. Because MIDI timing information is separate from the pitch information (key number), sequences can be recorded at one tempo and then played back at another. Recorded sequences can be copied, muted, chained and edited in a number of ways.

Most sequencers allow global editing of a selected region of a track, as well as note by note or "event" editing. Global editing usually includes such operations as quantization of note attacks or durations, transposition, and scaling of key velocities as well as copying and pasting. Event editing allows

MIDI
Musical
Information
Digital
Interface

the user to alter any parameter of an individual note such as its duration, key number (pitch), or key velocity (usually associated with volume). Tracks can usually be merged or re-routed to other MIDI channels.

Sequencers provide an interactive approach to composition which allows for a great deal of spontaneity. Students can improvise and experiment with ideas that they can later develop. Compositions can be built layer by layer and short sequences can be chained together to form larger segments. This approach to composition has become the 'method of choice' for many pop and rock oriented composers.

Sequencing software works best when students are familiar with the piano keyboard. Students who do not play piano may find real-time entry intimidating and may find even step entry too laborious. Fortunately there are other ways to enter music data, such as MIDI drum pads, wind controllers, pitch-to-MIDI converters, and direct entry from the computer using graphic icons or keyboard commands.

Common Sequencer Terms

Algorithm -a process of rules or steps for computation.

Controller -an input device capable of transmitting MIDI data, such as a MIDI keyboard, wind controller, or guitar.

Key number -the MIDI data which represents the number of key press. eg Middle C has a key number of 60.

Key velocity -the MIDI data which represents the velocity with which a key is pressed. This is most frequently associated with volume, but may be linked to other parameters such as depth of modulation or filtering.

Parameter -generally, a property of something that can be represented by a (numeric) variable. Parameters of sound include frequency, intensity and duration.

Quantization -rounding a variable to a particular degree of resolution, most frequently referring to the rhythmic resolution of sequencers. For example, if a sequence is quantized so the smallest rhythmic value is an eighth note, all intermediate values will be rounded to the closest eighth note.

Real-time -a term used to describe processes or devices which can handle data as it happens "live"

Scaling -the systematic increasing or decreasing of a value, usually referring to a MIDI parameter. For example, the key velocities in a sequence could be scaled upward by 10%.

Step-time - note by note entry of MIDI data where the timing information is manually selected for each note.

Composition/Notation software:

Composition/Notation programs are tools for producing a traditional musical score and parts. The features and cost of this category vary greatly depending upon the targeted market. Some programs are aimed at the education market, others are aimed at

professional desktop music publishing. Notation programs commonly have a graphic user interface in which musical symbols such as notes, rests, and clefs can be placed on a staff.

Early notation programs were command oriented, requiring the user to type short commands from the computer keyboard in order to enter and edit the score. More recent notation programs, however, allow the user direct manipulation of the musical symbols using a mouse. With direct manipulation users can typically drag notes up or down in pitch, resize bars by hand, and select areas of the score to be edited by boxing or highlighting them.

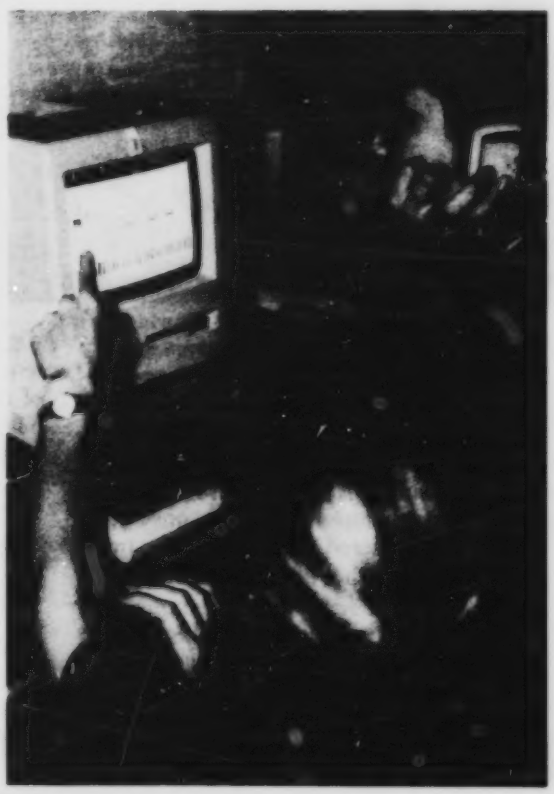
Notation programs are best suited to traditionally oriented music. Parts tend to have many of the limitations of traditional acoustic instruments. It is difficult to represent a large range on a single staff even using 8va and 8vb symbols.

Sequencer tracks, however, can represent a part spanning many octaves with a numeric score (called an 'event list') or piano roll notation. Sequencers often allow such options as multiple loops in parts and independent looping of tracks, however, looping within the score metaphor is usually restricted to traditional repeats.

Two important features of notation/ composition programs that should be considered are the playing capability, and the quality of the printed score and parts. Programs used for teaching composition should print out parts and scores of reasonable quality and be able to play the score accurately. Some programs aimed at the education market cover both areas f rly well, for example, *Deluxe Music Construction Set*, produced by Electronic Arts for the Macintosh and Amiga, and *Music Writer*, written for the Apple GS by Pyware. Both programs support MIDI as well as internal voices; four voices on DMCS, and up to fifteen on the Apple GS version of Music Writer. (See the software section of chapter five.)

Many of the high-end sequencers also have the capability of producing notation, or can export files to transcription/notation programs. *Personal Composer*, written by Jim Miller for DOS computers, and *Finale*, produced by CODA for the Macintosh, are

Two important features of notation/ composition programs that should be considered are the playing capability, and the quality of the printed score and parts.



capable of both sequencing and high quality (Postscript) notation. *Performer* (Mac), by Mark of the Unicorn, exports files to its companion notation program, *Professional Composer*. Files created by *Texture*, by Magnetic Music, and a number of other sequencers can be printed using *Copyist*, by Dr. T.

One of the advantages of composition programs is that the graphic representation of the score is easy to comprehend for students who are familiar with traditional notation.

Teachers of performance classes such as band and strings may find composition/notation programs useful for modifying stock arrangements. Parts can be simplified, or customized for the unique instrumentation of a particular group. In cases where doubling is appropriate, once a part has been entered it can easily be transposed for another instrument.

To provide additional small ensemble material, melodies can be arranged for two, three or four parts and then transposed for a number of different instruments. The parts can then be used in a mix-and-match fashion to provide various combinations of small ensembles. You can even transpose existing "SATB" vocal arrangements for any combination of woodwinds, brass, or strings.

One of the advantages of composition programs is that the graphic representation of the score is easy to comprehend for students who are familiar with traditional notation. Students with experience on traditional instruments can participate with very little introduction. Editing of scores can be fairly intuitive. In contrast, sequencers that only provide a numeric score tend to give a microscopic view of the composition and can be tedious to edit.

A major limitation of most composition/notation programs is that they tend to promote a traditional approach to composition. There are, however, a number of other kinds of composition programs on the market that offer alternate approaches to composition and experimentation with music.

Alternate approaches to composition:

Algorithmic composition programs extend the role of the computer in the process of making music. The computer controls much of the process of composition according to the software's composition algorithms and music database. In most cases this involves the generation and development of musical data by stochastic, or random, processes. The rules that govern the process can often be controlled or modified by the user.

The interaction of the user with the process is usually at a higher level than note by note control. For example, the user may control many parameters of the composition including the tonality, range, density of notes, rhythmic character and tempo.

Algorithmic composition programs vary greatly in the style of user interaction and the style of music produced. The output may be anything from four-part chorales in the style of Bach, to contemporary experimental music. The user interaction may involve setting parameters for the composition in advance or modifying the process interactively.

Programs that offer new ways of interacting with computers and music are sometimes referred to as **intelligent instruments** or **interactive composition** software. The output of these programs may be real-time "improvisation" for a live performance, or it may be a musical data file which can be modified by the user in a sequencer or notation program.

Among the best known algorithmic composition programs are,

by **Intelligent Music:**
- *M*,
- *Upbeat*,
- *Ovaltune* and
- *Jam Factory*,

by **Laurie Spiegel:**
- *Music Mouse*, and

by **Dr. T:**
- *Fingers*,
- *Tunesmith* and
- *Programmable Variations Generator*.

These programs offer alternative, non-traditional approaches to composition and interaction with computers and music.

Accompaniment:

MIDI sequencers can be used to provide accompaniment to individual performers or groups for rehearsals and even for performances.

Sequencers can be useful for students learning new solo material. Once the accompaniment has been entered into the sequencer, the student can choose the appropriate tempo. As the student becomes more comfortable with the material, the tempo can be adjusted toward the performance tempo.

Sequencer accompaniment is particularly useful for students learning to improvise. Students can solo over a looped chord progression at a comfortable tempo with the accompaniment mixed to emphasize any part. Common chord progressions such as blues chord changes can be transposed into any key. Guitar and piano players can practise 'comping' their parts 'live' while the bass and drums are played by the sequencer.

Choral directors may find sequencers useful for accompanying their choirs. Although a sequencer lacks the sensitivity of a human accompanist and will not adjust to the nuance of the performance, it may be the answer in the absence of a skilled keyboard player.

For rehearsal purposes, a sequencer may be useful for going over difficult passages. Most sequencers can easily be cued to a particular measure, tempos can be slowed, and unwanted tracks can be muted. In a performance a sequencer may be used to expand a keyboard accompaniment into a more elaborate "orchestral" background.

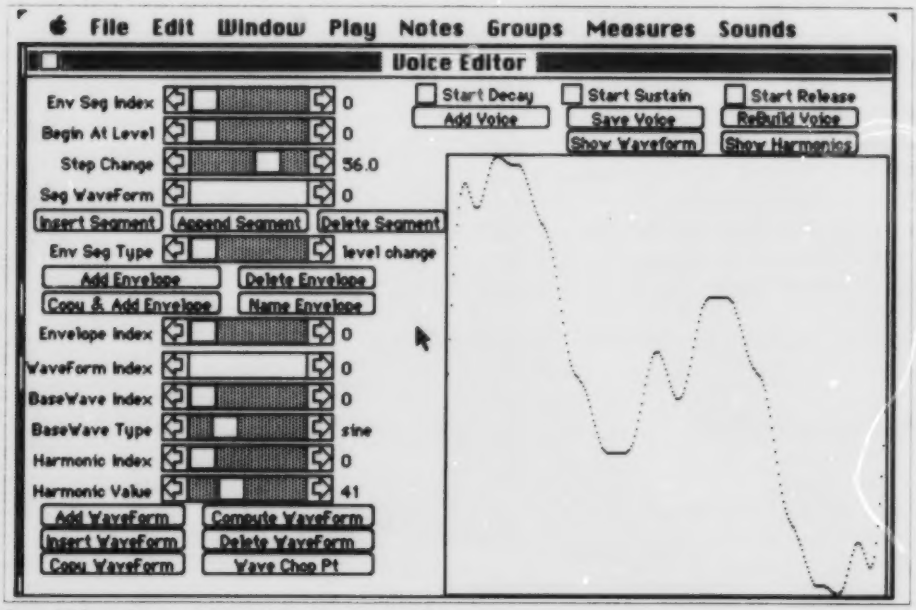
If a skilled accompanist is available, a MIDI keyboard may be considered as an alternative to an acoustic piano for accompaniment to some choral performances or musicals. Multitimbral synthesizers are capable of simulating many orchestral sounds as well as special sound effects and may fill the gaps in a "pit orchestra."

Sound Exploration and Design:

Computers and digital tone generators have given the user greater control of the design of sound. Synthesizers use any of a number of processes to generate complex timbres such as amplitude modulation (AM), frequency modulation (FM), wave shaping, additive synthesis, waveform reconstruction, and pulse code modulation (PCM) digital sampling. Composers and performers choose from a wide range of interesting and dynamic timbres and can design new sounds and create new "instruments".

Most synthesizers and tone generators allow the user to create, edit and store sounds. Editing sounds on an instrument, however, may be awkward and confusing, given the limited size of the display screens and the frequent use of multifunctional buttons.

Voice editing software is available for most synthesizers and computers to enable the user to edit sound parameters in an easier, more intuitive way. Using the computer monitor for display, rather than the typically small display of the synthesizer, most voice editors allow the user to see more of the voice parameters at one time, and control them directly. Some software packages function as both voice editors and **patch librarians,** which can store entire banks of "patches", or voices, on floppy disks rather than expensive RAM cartridges or cards.



from *Deluxe Music Construction Set, version 2.5*

Digital samplers record short segments of sound in the form of digital information which can be stored, edited, and played back at different pitches. Sample editing may consist of scaling the amplitude of a sample, determining the exact starting and ending points, or setting the the sample's

loop points. Sample editors are programs which assist the process of editing, providing a graphic display of the waveform, often with multiple views, and the necessary editing commands and functions. Some sample editors can handle a number of different sample formats and can convert samples from one format to another.

Composers and performers can not only design their own sounds, but with some of the current synthesizers, they can also create special scales and tunings. Musicians using MIDI equipment are no longer bound exclusively to equal tempered tuning. Many of the current electronic instruments can be used with alternate tunings such as Pythagorean or Just tuning, or custom microtonal tunings.

The design and manipulation of sound is an aspect of musical creativity that has been enhanced by personal computers. A unit on acoustics, sound synthesis and sound design can now be integrated with composition or performance courses.

Computer Assisted Instruction:

Computers can also be used to assist instruction in areas of music theory and ear training. The learning objectives range from fundamentals such as

- developing basic visual and aural discriminating skills,
- to using functional harmony and
- identifying jazz chords.

For example, elementary teachers can use music CAI programs and musical games to reinforce skills such as recognizing note names or discriminating between melodic steps and leaps. Secondary teachers can use music CAI software to integrate theory in performance classes in a systematic way.

Ear training drill and practice programs can generate intervals, scales, or chords to be identified by students, evaluate their responses, and monitor their progress. Some programs work with the internal sounds of the computer, others require a MIDI instrument and interface. See the evaluations for *Listen* and *Practical Theory* and Allan Anderson's chapter, 'Computer Assisted Instruction in the Music Classroom'.

Implementation Suggestions

Around the province, computer music activities are being implemented at various grade levels and in a variety of classroom situations. This chapter offers some guidelines for that implementation. Since not all schools have the same computer facilities, timetable, or policies, the recommendations are fairly general.

Where is policy for the use of computers in the school system determined?

Provincial Level

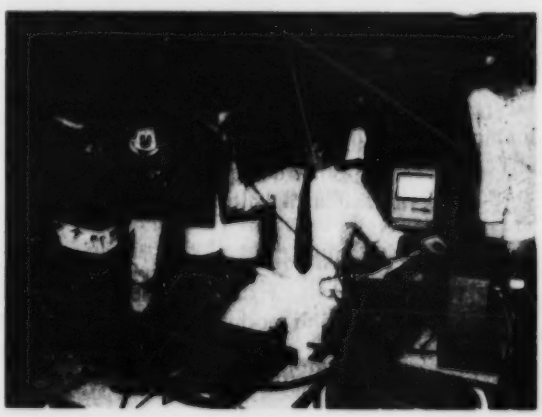
The role of the Ministry of Education should be "to establish the broad priorities and principles under which the applications of computers in the schools should be carried out, and encourage the Districts to use these principles to guide their planning and implementation", according to the *Provincial Advisory Committee on Computers: Interim Report*, published in 1987. The recommendations of the PACC report include the use of computers in "Creative applications for art and music education."

District Level

Most school districts have a committee to develop policies and plans for the use of computers and related technology within the curriculum. It is important to individual music programs and to the district as a whole that musical applications are not overlooked at this level. If possible, a representative of the district's music educators who is experienced with computer music applications should be a member of, or consultant to, the computer policy committee.

School Level

Although policy may be determined at other administrative levels, implementation is generally at the school level. Interpretation of provincial and district policy is often broad enough to account for considerable variation between schools. In many cases, school administrators may not even be aware of the potential use of the computer as a compositional and instructional tool in music. It is important, therefore, that the school administration and teaching staff are made aware of the exciting and educationally valid applications of computers in music.



Access and Expertise

To implement computer music applications requires sufficient access to computers, and the necessary expertise. The following are a number of suggestions to improve your **access to computers:**

- **organize musical activities** for extra-curricular times such as before and after school when the computer lab is free;
- **communicate your needs** to the school administration and the computer contact person, or computer lab manager;
- **support your case with solid arguments,** if you are making a case to administration for computer access, and, if possible, prepare a demonstration;
- **ask for creative scheduling** with other classroom teachers;
- **propose a pilot project** for computer music application.

There are several areas of expertise that are important in most computer music applications, including: computers in general, specific software, MIDI equipment, music, and for some applications, composition. It is difficult for anyone to be expert in all of these areas, especially if you also dealing with the rest of the curriculum. Here are some suggestions for improving your **expertise:**

- **share expertise whenever possible.**
  If you are comfortable with music, but not with computers, look for another teacher on staff who can help you on the computer. Staff members who teach neither music nor computer science may have expertise in one or both.
- **look for professional development opportunities.**
  There may be school or district based opportunities to fill some of the gaps in your background. Ask for what you need: computer workshops at the school level, and workshops on MIDI equipment and software at the district level. Use the district support staff such as the music or arts coordinator and the computer coordinator.
- **district based equipment**
  Perhaps a pool of district based equipment such as a computer, interface, keyboard, sound module, and powered speakers could be made available to let teachers learn to use this equipment. District copies of major software packages could also be made available to teachers.

Elementary schools

In most elementary schools the demand on computer resources exceeds supply. The priority of computer applications may be determined either at the district or school level In either case, there may be opportunities to use the available resources for music if the teaching staff and administration are aware of the possibilities. The following are implementation models that may apply in some circumstances.

Classroom teachers

In schools that have computer labs, classroom teachers usually have scheduled access for some applications, the most common being writing. If scheduling constraints permit, a number of opportunities for musical applications are also possible for a classroom teacher. Here are some suggestions:

- **Run a self contained unit on composition or sound design using appropriate software.**
  The unit could be four to eight classes long. If the computers have internal sound capability, you will need only headphones and perhaps adapters. Do not try to run a computer music class without headphones!
- **Integrate music with other creative activities.**
  A group project such as writing a "radio play" can involve some students in writing a music background while other write the script.
- **Share your expertise.**
  If you have the expertise to teach computer music, try platooning with another teacher.
- **Use computer music as an enrichment possibility for students who display a particular interest in music.**

Music specialists: General music, Band, and Strings

If you are a music specialist you have the musical expertise to make excellent use of current music software. If you also are comfortable with the school's computers, you may want to try to integrate some computer based activities with the music curriculum you now teach.

There are many aspects of the elementary music curriculum that can be greatly assisted by computers. Units can be designed to integrate computer-based composition with performance in areas such as melody, rhythm, form, and harmony.

Most elementary labs will not accommodate an entire class. If this is the case, look for activities that have an off-computer component for the remaining students. Another possibility is to have students work together, though this creates a problem if students are using headphones.

Itinerant Computer Music

An itinerant computer music specialist is another possible model at the elementary level. For the last six years, my own position in the North Vancouver School District has included a district assignment teaching computer music. The computer music portion of my position has increased from an initial .1 FTE (full time equivalent) to its current level of .5 FTE. The other part of my position has been teaching elementary band at two schools.

Here is a brief description of the computer music component of my assignment:

- **the purpose** is to provide students with an introduction to music composition using computers and current music technology;
- **each school is allotted** two half days per week for a four week period;
- **one student per computer** (most labs consisted of 13-15 computers);
- the students involved are usually the **grade seven classes;**
- **each student participates in from four to eight one hour sessions,** depending on the number of classes involved;
- **students record audio tapes** of their composition;
- **a class tape is also recorded;**
- **my equipment** includes a class set of headphones and adapters, MIDI keyboards and sound modules, a four track tape recorder, and a class set of music software.
- I have found it possible to cover approximately **five schools for each .1 FTE.**

A computer music specialist can also provide inservice support. With rapid change in both music hardware and software, it is difficult for most teachers to stay informed. A computer music specialist can act as consultant, develop materials and give workshops.

The position of computer music specialist is not common in this province, often existing as a result of individual initiative. Submitting a well-developed proposal for a pilot project to the district administrationl will at least alert them to the possibility. The proposal should have the following components:

- **a rationale;**
- **a description of the program** including a sample schedule and the amount of teaching time involved;
- **a statement of goals and learning outcomes** related to the current music curriculum;
- **a detailed description of equipment needs**, including costs;
- **letters of support**

Secondary Schools

The demand on computer resources is just as great at the secondary level as it is at the elementary level, although in most cases more computers are available. In situations where only one computer is available to the music department, it is difficult to imagine meeting the needs of a sixty piece concert band. On the other hand computer lab time may be available, both within and outside of the regular timetable.

- **Keep in touch** with the administration and the teacher who manages the computer lab. You may be able to share or alternate lab times with another class.
- Arrange to **have interested students involved in self directed projects** in the computer lab in X-blocks (before school), lunch hours, and after schools.
- Look into various funding possibilities to **set up a small lab** (four or five computers) within the music department.

Performance classes

With planning and good fortune, performance classes could be set up to take advantage of current music software. Whether the ensemble is a concert band, jazz band, concert choir, jazz choir or strings class, useful applications are available if the logistics can be managed.

Here are some suggestion for performance classes:

- **Integrate theory and performance** with compositional projects;
- **Students can write compositions and arrangements** for small groups within the class.
- **Public performances** can routinely include student compositions;
- **Reinforce theory with tutorials**, and drill and practice software.
- **Develop ear training.**

Composition classes

Composition classes are probably the most obvious to benefit from computer music software and MIDI equipment. The enrolment in composition classes is usually small enough that the class can make good use of a small number of computers. If an entire lab is available take advantage of it, but even limited access to a lab can be very useful. Students who are not working on computers can work with other media such as classical tape, and live acoustic and electronic instruments.

Getting the class to the level of competent user is difficult with only a few computers. Holding a number of extra-curricular sessions may be necessary in the early weeks of the course. Using competent students as tutors and lab monitors might be helpful.

Computer Studies 8/9

Computer studies programs at the junior secondary level have the flexibility to offer a number of interesting computer applications. It may be possible to offer a computer music component as part of computer studies.

Computers in the Elementary Music Curriculum

Computers and music technology can be used in the elementary grades to help achieve a number of objectives of the music curriculum, including many applications described in the *Utilization Overview (chapter 1)*. The major categories of music software at the elementary level are; creativity tools (such as composition programs), tutorials and drill and practice programs (usually dealing with basic theory and ear training), and musical games.

The *Elementary Fine Arts Curriculum Guide /Resource Book* (1985) contains a rich framework for the development of an elementary music curriculum. It includes a set of general goals common to art, drama and music, as well as more specific learning outcomes, and an outline of materials and activities for each of these areas. It is designed to be useful to general classroom teachers as well as music specialists.

Many of the goals and objectives stated in the *Curriculum Guide* can be achieved, in various classroom contexts, with the use of computers and current music software. For example, the following goal and its related learning outcomes, which focus on the affective and cognitive domains, can be used to demonstrate a number of ways that computers can be used in an elementary music program.

Goal:

to develop the child's ability to explore, express, communicate, interpret, and create.

Learning outcomes:

By the end of grade 7, the student should be able to:

- ***use a variety of media and techniques to explore the elements of music (2.3.1);***
- ***demonstrate an ability to express feelings and ideals through music (2.3.2);***
- ***demonstrate the ability to communicate images through sound and music (2.3.3);***
- ***demonstrate the ability to improvise and work experimentally with sound (2.3.4);***
- ***demonstrate the use of appropriate music vocabulary and notation (2.3.5).***

Experiment with sound

Computers and music technology are expanding the ways in which students can explore music and experiment with sound. Children's musical experience should include many opportunities to create and perform their own music as well as to perform music created by other people.

Most popular computers in elementary schools are capable of producing sounds. Some, such as the IBM PC and the Apple II,

are limited to one sound (the 'beeper' which can be controlled for pitch and duration). Others, such as the Commodore 64 and Amiga, IBM PS/2 systems, the Apple IIGS and the Macintosh, contain sound chips which can produce several sounds at once with a variety of envelopes and timbres.

The internal sounds are used for anything from sound effects in games, to synthesized speech, to instruments in composition programs.

Exploration

Exploration in music can include creating your own instruments and sounds. Computers can give students the ability to manipulate many aspects of sound with a precision they could not otherwise achieve. With a number of composition programs such as *Music Shop* (Broderbund-C64), *Music Studio* (Activision -Amiga, C64, Apple IIGS, IBM-PC), and *Deluxe Music Construction Set* (Electronic Arts- Mac, Amiga), students can modify existing instruments or build their own. They can experiment with envelopes and filtering, compare simple wave forms and create their own 'instruments'. They can then use the instruments they have created in their compositions.

Pyware Instrument Designer (Pygraphics - Apple IIGS) extends the instrument designer concept to a stand alone program which gives students control over a large number of sound parameters. The sounds can then be used with the composition program *Music Writer* (see Martin Summer's review of these two programs).

Mac Recorder is an inexpensive sampler for the Macintosh that can be used to teach students about sound and as a tool to digitize speech, instruments and sound effects for use in *Hypercard* projects.

Learning outcomes 2.3.2 and 2.3.3 draw direct comparisons to other forms of artistic expression such as visual art and creative writing. In those areas, students are given the opportunity to create their own images and express personal feeling from their earliest experiences. A comprehensive music program, one which includes the above objectives, can give students the opportunity to express their own images and develop compositional skills.

Composition

Composition can be a tricky area to address, particularly when it involves the difficulties of understanding and communicating with traditional notation. Computers,however, can allow students to see and hear musical ideas. They can experiment with melodies and chords and judge for themselves if they like the sounds. Changes can be made easily and heard immediately. Editing functions usu-

ally include the ability to clear, or cut and paste sections, and sometimes include manipulations of notes such as transposing, raising or lowering diatonically, inverting chords, and increasing or decreasing rhythm values.

Concepts of melodic and structural design are easier to teach when students can actually use them themselves. The concepts can be demonstrated graphically and aurally and immediately incorporated into short activities. Because of the ease of manipulation, computers can help students think of musical composition in much the same way as composition in language or art, as the creation and manipulation of ideas and images. Involving students in compositional processes give them the opportunity to develop new means of expression.

Improvisation

Learning to improvise with sound and music (learning outcome 2.3.4) is an unlikely area to expect computers to be useful. Most of the musical activities that emphasize improvisation currently involve traditional instruments. However, an interesting category of music software is emerging which uses the computer as a high level instrument for 'interactive' performances. They are a difficult class of software to adequately describe without live demonstration.

Briefly, most of these programs create real-time variations on melodic and rhythmic ideas entered by the composer and allow the composer also to be conductor and performer. (See the chapter on Interactive Composition.)

Although the majority of these programs are aimed at the secondary level and higher, a few can be used with elementary students. One example is *Ovaltune,* by Intelligent Music (Macintosh Plus or SE). *Ovaltune* lets students improvise with graphics and sound by using the mouse and the computer keyboard. Students can also create performances of their graphics and music on videotapes.

The following goal and learning outcomes can also be assisted with computers and music technology.

Goal:

to develop the child's skill and technical ability in the arts.

Learning outcomes:

By the end of grade 7, the student should be able to:

- ***recognize, create, and perform rhythmic patterns (3.3.1);***
- ***recognize, create, and perform melodic patterns (3.3.2);***
- ***recognize, create, and perform dynamic variation within musical works (3.3.3);***
- ***recognize, create, and perform variations of tempo within musical works (3.3.4);***
- ***demonstrate a knowledge of the principals of harmony (3.3.5).***
- ***demonstrate a knowledge of musical timbre (3.3.6);***
- ***recognize how elements of music are organized to produce musical form (3.3.9);***

Computer Assisted Instruction

All of the above learning outcomes can be assisted by the use of composition programs, CAI (computer aided instruction) programs, and musical games. Each one can

be the focus of a short compositional task using any of a number of the currently available composition programs. Some of the outcomes may also be addressed in tutorials or games.

At the elementary level, the CAI programs and music games categories overlap. The games usually have some instructional objectives, and the CAI programs have to be

engaging to be successful. A large number of musical games were written for the early microcomputers, the Apple II and the Commodore 64 in particular. These programs involve students in game-like activities to develop visual and aural discriminating skills. Programs exist to help students develop pitch discrimination and tonal memory, name notes, and recognize musical symbols. CAI programs have had mixed reviews in many subject areas, but may be useful in some areas of music such as ear training and music fundamentals.

Computers as Enrichment

Computer based activities should reinforce and augment other musical activities. The enriching activities describe above, such as composition and exploration with sound, cannot replace the physical experiences of singing and performing instruments. They should not be considered in isolation, but should be used to implement an integrated 'whole music' program.

Although access to a large number of computers, is ideal to achieve optimum results, a lot of learning can take place under less ideal circumstances. Teachers as well as students can learn how to use computers to explore and create music with limited equipment.

The development of lesson plans and strategies to incorporate new technology requires a great deal of experimentation and review. The process can begin with a single computer and a single program. As school based technology resources improve, the opportunities to integrate the equipment into the fine arts curriculum will improve.

Computers are effective tools for developing creative expression and musical concepts and skills within the elementary music curriculum.

Coping With Administrivia

by Dr. Dallas Hinton

Computers can help the music teacher by:

- ***calculating marks,***
- ***tracking instrument rentals and repairs,***
- ***maintaining inventory records,***
- ***cataloging and filing music,***
- ***preparing budgets, requisitions, and financial reports, and***
- ***recording student fund-raising activities and accounts.***

In any music teacher's life there are a large number of non-teaching tasks which require attention. Until recently, these were all time-intensive tasks which could not be done by anyone other than the teacher involved. During the past few years, however, the increase in numbers of microcomputers has led to the development of a number of programs which make these tasks very much easier.

Cataloguing Music:

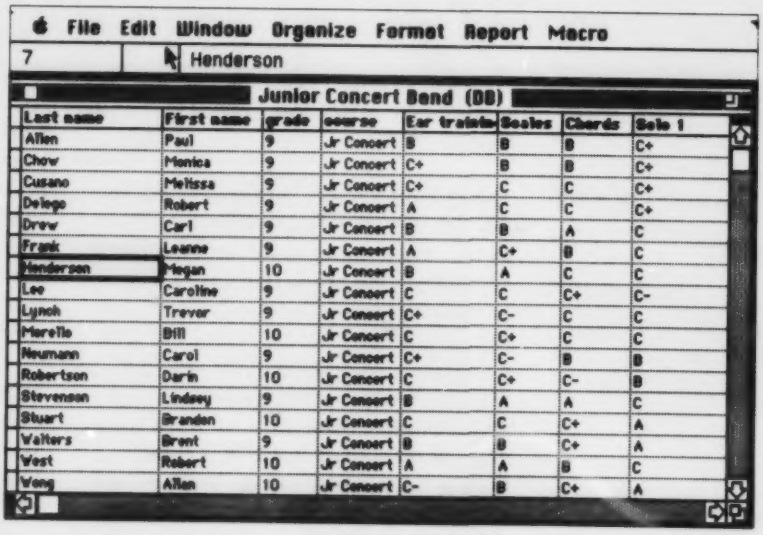
Most music teachers have a large collection of band and choir music. If it is to be useful on more than one occasion, it must be catalogued and filed in some manner so that it can easily be located for future performances.

Using Standard Utilities Like *Works*:

It is fairly easy, although somewhat time-consuming, to set up a system to track information. This approach is quite workable and relatively inexpensive, although it can sometimes prove tricky to generate reports.

For example, a spreadsheet can be used to track student fund-raising and instrument rentals, and a word processor or graphics program to prepare concert programs, newsletters, and flyers.

A distinct advantage of using a standard utility like *Works* is the flexibility it gives. The music teacher is not confined to preset headings and categories, but can arrange files precisely to suit the specific situation.



Last name	First name	grade	course	Ear trainin	Scales	Chords	Solo 1
Allen	Paul	9	Jr Concert	B	B	B	C+
Chow	Monica	9	Jr Concert	C+	B	B	C+
Cusano	Melissa	9	Jr Concert	C+	C	C	C+
Delago	Robert	9	Jr Concert	A	C	C	C+
Drew	Carl	9	Jr Concert	B	B	A	C
Frank	Leanne	9	Jr Concert	A	C+	B	C
Henderson	Megan	10	Jr Concert	B	A	C	C
Lee	Caroline	9	Jr Concert	C	C	C+	C-
Lynch	Trevor	9	Jr Concert	C+	C-	C	C
Morello	Bill	10	Jr Concert	C	C+	C	C
Neumann	Carol	9	Jr Concert	C+	C-	B	B
Robertson	Darin	10	Jr Concert	C	C+	C-	B
Stevenson	Lindsey	9	Jr Concert	B	A	A	C
Stuart	Brandon	10	Jr Concert	C	C	C+	A
Walters	Brent	9	Jr Concert	B	B	C+	A
West	Robert	10	Jr Concert	A	A	B	C
Wong	Allen	10	Jr Concert	C-	B	C+	A

database using Microsoft *Works*

Standard utilities also make it easier to share information between different tasks. For exammple, to create form letters to parents using a marks database.

For many departments, using these standard programs will be quite adequate, especially since the school may already have site-licensed copies of suitable programs.

Customized Software:

There are considerable advantages to using programs which are customized for the music teacher's needs. For example, a pair of programs titled *Choir Master* and *Band Master* are now available. Essentially customized databases in the *dBase III* mold, these programs allow the teacher or librarian to record the title, composer, arranger, and publisher of each piece, as well as file number, voicing or instrumentation, last performance date, cost, liturgical season, type of work, and so on.

Band Room records the type, make, model, serial number, case number, condition, and location of each instrument.

The reporting forms are pre-defined, so that the user merely specifies the information to be searched for, and the rest is automatic. One of the benefits of this computerization is the possibility of getting a printout of, say, all pieces with a soprano solo, written in the key of A♭ Major and which are suitable for Easter. As always, the main problem is the initial entry of data; once that task is done, finding information and updating records is quite easy and takes only a little time.

To accompany *Choir Master* and *Band Master* are *Reference Librarian* programs. These are intended for use within a school district and enable the user to find the location(s) of each piece of music. This capability is a blessing for the coordinator faced with finding sufficient copies of "Big Rock" for the massed band concert.

One of the benefits of computerization is the possibility of getting a printout of, say, all pieces with a soprano solo, written in the key of A♭ Major, and which are suitable for Easter.

Another of the database type of programs is *Band Room*, a program designed to track the inventory of instruments. It records the type, make, model, serial number, case number, condition, and location of each instrument, allowing reports to be generated based on location, type, or case number. There is also a limited accounting function which will track rentals of instruments and produce reports of amounts owing and paid.

A District Solution

In the Vancouver School system, a decision has recently been made to equip each secondary music classroom with an administrative computer system consisting of an MS DOS computer with a 30 meg hard drive, a printer, and a 2400 baud modem. Each system will be supplied with the *Choir Master*, *Band Master*, and *Band Room* programs, in addition to word processor, spread sheet, and graphics programs.

All secondary schools in the district are now using the Columbia School Systems' package for marks and report card generation. This music computer system will also provide teachers with ready access to the ap-

propriate records and mark managing programs.

As well as providing the individual teacher with a number of very powerful tools, the inclusion of a modem means that teachers can make use of technology to transfer information quickly and easily among several schools. In districts where there is a central computer system, teachers could make use of the modem to transfer inventory information, order audio-visual materials, and even exchange messages with district staff.

The computer is capable of saving many hours of work in the office; there are now many good programs to save the music teacher time and effort. In the near future, every well-equipped classroom will have its own computer system, and it is up to the music teacher to ensure that the programs and equipment are put to good use.

Computer Assisted Instruction in the Music Classroom

by Allan Anderson

In 1977 the first microcomputers were sold to the general public. This opened up a whole new world of technologies that were, until then considered to be only dreams.

The first instructional software for music was developed on the Apple II by a company called Micro Music, Inc. The Apple II is still being used today along with it's updated versions, the Apple IIe and the Apple GS. New computers such as the Amiga, Atari ST, IBM PC and compatibles, and the Apple Macintosh have helped us to explore a much greater variety of instructional techniques The use of a mouse has also helped to make computers a great deal more user friendly.

School boards throughout British Columbia have tended to use the Apple II series or Commodore 64 computers in the Elementary grades. Secondary schools tended to use Apple GS, Macintosh, or IBM PC compatibles. Atari ST and Amiga are excellent computers, particularly for music, but they have not been used in significant numbers in B.C. schools. Ministry selected vendors for 1989/90 are Apple Canada Inc., Commodore Business Machines Ltd., Computers in Education Inc., IBM Canada Ltd. and VTECH Computers (Canada) Ltd.

Most instructional software programs concentrate on exercises which develop specific music skills. Initial presentation and explanation of the material is left to the classroom teacher. Music theory, ear training, and keyboard skills are some of the most popular instructional programs that are available today. Of these, it is my opinion that ear training is probably the most useful at the present time.

Ear Training

The computer has infinite patience and is not nearly as threatening as an instructor. Many programs are available for ear training. The best of these incorporate a theory text that can be used in conjunction with a set syllabi. My own experience has shown that without a set curriculum, students tend to get bored very quickly. Also, I believe that ear training cannot be taught in a vacuum, it must be constantly related to practical applications. Many programs will allow students to keep track of their progress as they work at their own speed. The best programs will also give students the opportunity to interact with the computer.

Music theory, **ear training**, and **keyboard skills** are some of the most popular instructional programs that are available today. Of these, it is my opinion that **ear training** is probably the most useful at the present time.

Computer theory programs work especially well for a large band or choir class where students can go to the lab and work at their own speed during early mornings, lunch hours, or after school.

Music theory programs

are starting to appear in greater numbers. Some of these come with textbooks and workbooks. Students have the option of skipping around to different topics and levels of difficulty that are applicable to their own individual needs.

Instructors should try these programs out first to ensure that they are applicable to their school curriculum. The how and why of teaching Music Theory is not exactly an area of agreement amongst music teachers!

For teaching basic theory concepts, definitions, and drills, the computer works very well. Some programs even come with tests that measure a student's performance after each level or topic. This works especially well for a large band or choir class where students can go to the lab and work at their own speed during early mornings, lunch hours, or after school. This allows the instructor more time during class to work on interactive and creative activities.

Keyboarding Skills

Teaching keyboard skills is another area of CAI (computer assisted instruction) that is just starting to come of age. Computers can teach you how to play the keyboard at any level and in any style. Like with ear training and theory, you can progress at your own speed.

Keyboard labs are starting to appear in some school districts. Students work at their own keyboard while the instructor monitors their progress from a central controller. This has proven very popular in the colleges where they teach class piano. Several manufacturers have these labs available.

MIDI

The most practical software of today makes use of MIDI to create an interactive environment. MIDI is a hardware specification for an interface and a software protocol for communications between electronic musical instruments and computers, that is, a method for sending musical data between musical instruments and computers.

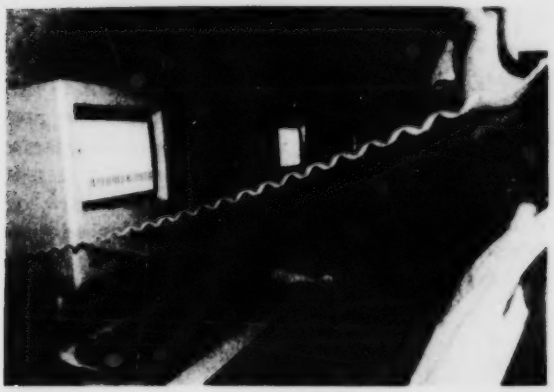
In music education, the MIDI allows the student to enter into a dialogue with a computer program using a musical instrument rather than with a typewriter style keyboard. The program allows students the opportunity to interact in a more musical context. Unfortunately, the interaction usually involves certain keyboard skills that not every student possesses.

There are other methods of sending MIDI information using drum pads, wind control-

lers, and voice activated microphones, but they each have their own unique sets of problems. Remember the rule - try it out before you buy it !

Optical disks

Optical disks are appearing as mass storage devices for computers. With storage capacity measured in hundreds of megabytes,



optical disks will open up new possibilities in musical applications. I believe that in the future, music teachers will be able to make great use of these, especially in areas such as music history, musical style, instrument repair and maintenance, performance topics, etc.

Dedicated sequencers

Dedicated sequencers are starting to appear in a few schools. These are computers that are strictly dedicated to music. Many manufacturers are developing software packages that can be used in the classroom to teach the areas that have been discussed. These units tend to cost less than a computer and are sometimes easier to use - but not always. Once again I suggest that you try them out to make sure that they will do what you want.

The PR100 Roland sequencer is a case in point. I use it all of the time to sequence and to act as a keyboard tutor. The Toronto Conservatory disks and the other play along disks work very well. The instructional theory disks are not quite as good. The small LED viewer is just not large enough to create an effective learning environment. Also, some of the instructional programs are just too confusing for most of my students. In my opinion, they need to standardize their programming more.

In conclusion, it is my opinion that, to make use of this new software effectively in the classroom it must be as user friendly as possible. Instructional software should be in the classroom to assist in the instruction of a given curriculum. If you need to spend a great deal of time teaching students how to use the program then it is useless as an aid. You teach "technology" in the Composition Lab, not in the Theory Lab!

Also, we must consider what material we wish to teach. Do we want to continue teaching traditional harmony and theory concepts or do we want to progress to the more aggressive role of teaching musical skills and ideas that our students will need for their future? If so, we should be looking at technology in a different way. Musicality should never change, but the methods and the instruments that we use to teach these concepts will and should change.

MIDI is a hardware specification for an interface and a software protocol for communications between electronic musical instruments and computers.

Purchasing Considerations

Setting up a computer music system for your school or music program can be an intimidating task, considering the costs involved and the number of choices to make. The most important and costly acquisitions will be the computer, the synthesizers or sound modules, and the music software.

A Music Workstation

The basic requirements for a music workstation will include a computer capable of running music software and a sound source that is adequate for your needs. If the software is a sequencer, a MIDI controller must be included as part of the workstation. Printers and audio tape recording systems may be shared by more than one workstation. The first question you may want to ask yourself is:

What kind of computers does the school have?

If you plan to purchase a computer for a stand-alone music workstation, one consideration might be compatibility with the computers used in the school lab. The advantages will include having access to a larger library of software, as well as printers and other peripherals. If the school has more than one kind of computer, determine which type better meets your needs.

In addition, you may be able to arrange regular access for your students to the school's computer lab. Then you could consider a more comprehensive utilization of computers within your program. If the school computers have internal sound capability, you may only need headphones and the appropriate software to run a theory or composition unit as an integral part of your program.

Internal Sound Resources:

Some computers have internal sound capability. For example, the Macintosh and Commodore Amiga can produce four independent voices, and the Apple II GS is capable of up to fifteen independent voices.

Each of the above uses an eight-bit DAC (Digital to Analog Converter) to produce sound which, although certainly not professional quality, might well be adequate at least as a temporary sound source. Taking advantage of the computer's internal sound capability is more significant if you have access to a large number of computers. You may be able to run an application for the class using only headphones and the internal sound of the computers.

If you already have or do not need a keyboard, a **multitimbral sound module** will give you a compact, portable sound source for composition.

Requirements of the software:

The specific hardware requirements of the software you wish to use should be considered before you purchase a computer. Some programs require a minimum amount of internal memory. Many music programs running on DOS computers require a Hercules or EGA (Enhanced Graphics Adaptor) graphics card and an appropriate monitor in order to provide high resolution graphics.

Some of the larger music programs are too large to be stored on a single floppy disk and must be run from a hard disk drive or at least require a second floppy drive. If you already know what applications you want to use, discuss the specific requirements of the software with the vendor.

What sound resources?

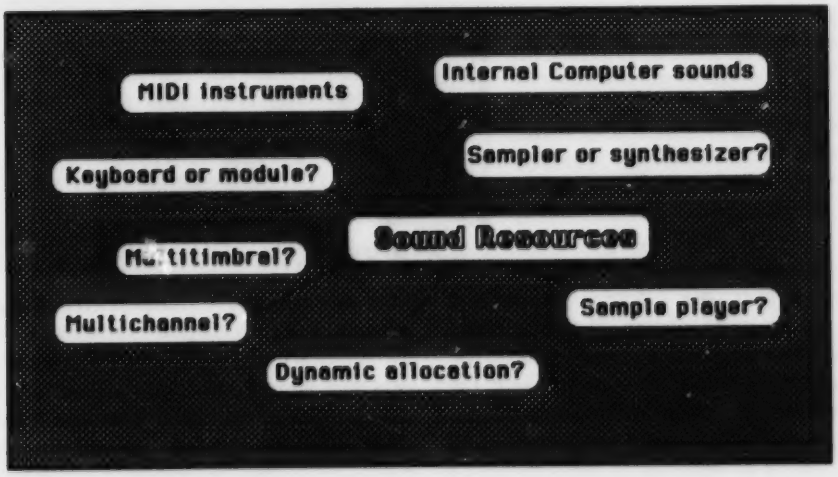
When determining which units you will purchase, it is important to consider sound sources. The major purchasing decisions include whether to buy a module or a keyboard, a synthesizer or a sampler, and how many units you will need.

If the computer does not have internal sound capability, it must be connected to an external MIDI sound source via a MIDI (interface).

Multitimbral capability

Sound sources should, if possible, be multitimbral, that is, capable of producing more than one timbre simultaneously. Multitimbral capability is particularly important for composition, enabling students to orchestrate their compositions with a variety of colours without having to use several different synthesizers.

Most multitimbral sound modules and synthesizers produce a minimum of eight voices. Some can produce as many as sixteen or thirty-two different notes, although the number of different timbres seldom exceeds eight. Some multitimbral instruments include a complete drum kit and auxiliary percussion sounds, and therefore eliminate the need for an separate drum machine.



Dynamic allocation of sounds

A common feature of multitimbral synthesizers is the ability to assign each sound or voice to a particular MIDI channel and region of the keyboard, a feature sometimes referred to as *multichannel capability*. Assigning voices to MIDI channels enables a composer to in effect divide the unit into a number of independent instruments and control each through its own MIDI channel.

Some multitimbral units require the user to allocate the number of notes for each channel. If the music on that channel exceeds its allocated number, the additional notes will not play. Other units allocate the sound resources dynamically and will play whatever number of voices are required on a channel, as long as the resources are available. *Dynamic allocation* of sound resources provides much greater flexibility for the user and a more efficient use of the resources.

Dynamic allocation of sound resources provides much greater flexibility for the user and a more efficient use of the resources.

Module or keyboard?

For most applications it will be necessary to have at least one keyboard. For additional units, the choice between sound module or keyboard will depend upon a number of factors, such as the space available, the need for portability, and need for additional keyboards. Rackmounted modules can fit very neatly into a small space and are easily portable. If students will be sharing the school's computer lab, portability may be an important factor. If you intend to emphasize sequencing in your program, having more than one keyboard will be important.

Digital pianos provide touch sensitive, weighted keyboards which may be suitable as MIDI controllers. However, keep in mind that, in most cases, digital pianos do not have continuous controllers for modulation and pitch bend and therefore cannot transmit those MIDI expressions. Most keyboard synthesizers, on the other hand, do not have weighted keys, but do have continuous controllers.

For expressive sequencing, pitch and modulation controllers will be important features, however, for accompaniment, most piano players will probably find a realistic piano feel more important. MIDI keyboard controllers which have both weighted keyboards *and* continuous controllers are usually expensive.

The challenge for synthesis technology has been to generate sounds that are as dynamic and interesting as naturally occurring acoustic sounds

Synthesizer

Synthesizers generate sound using one or more of a number of methods or algorithms such as

- frequency modulation (FM),
- amplitude modulation (AM),
- additive synthesis (combining basic waveforms to create complex timbres),
- hybrid synthesis (combining different methods)

and so on. The challenge for synthesis technology has been to generate sounds that are as dynamic and interesting as naturally occurring acoustic sounds.

Because the harmonic spectrum of acoustic sounds changes during the life of the sound, most synthesis methods include ways of varying the timbre. Some apply low frequency oscillators (LFOs) to rhythmically vary aspect of filtering and the depth of modulation and to add vibrato or tremolo. Even using these methods, synthesizers rarely emulate acoustic sounds well and are best used to create their own unique timbres.

If live performance and multitimbral recording are priorities, a sample player will probably best meet your needs.

Sampler

Another technology used to produce sound is called the *digital sampler*. These instruments can sample (record) acoustic sounds then play them back at other pitches. Digital samplers do not use complex algorithms to generate sound, but merely store a digital representation of the acoustic waveform as numbers in a *wavetable*. The reproduced samples will have the same dynamic sound characteristics as the original sound source, but can be transposed to different pitches, and altered in a number of ways.

The major limitations of the sound quality in samplers are related to the *sample size* (the number of bits per sample), and the *sampling rate*. Most professional samplers use samples with between twelve and sixteen bits of information, and have sampling rates in the area of 32-44 Kilohertz. Many samples of acoustic instruments sound distorted when transposed more than a few semi-tones. To sound realistic over the range of the instrument they must be sampled several times in different ranges. This feature, called *multiple sampling*, requires a considerable amount of internal memory.

The ultimate test of a sampler is, of course, how good it sounds. Side by side comparisons of samplers from different manufacturers are best if you can arrange them. Listen to the quality of a variety of sounds such as piano, voice, wind and string instruments over their natural ranges. Also consider the availability of a library of samples from the manufacturer or third party sound developers.

Sample players are units which are capable of playing sampled sounds, but are not capable of recording samples. The sound information is contained in wavetables stored in ROM (read only memory) or in external cards and cannot be edited or erased by the user. In some cases the raw sound information can be further modified with filters, envelope generators, and effects such as chorusing or phlanging.

An advantage of sample players is the immediate access to a large number of ROM-based sounds. Additional sounds, stored on PCM (pulse code modulation) cards can usually be accessed as quickly as the internal wavetables. In a live performance, the ability to immediately switch between sounds is important. Loading a bank of samples from disk on some samplers can take a long time, often over a minute for a complete bank of sounds.

The disadvantage of sample players is the inability to create your own samples. Samplers can be useful for teaching fundamentals of acoustics, and for experimentation with sound. Using a sampler, students can sample their own voices and instruments, then play their compositions with those sounds, whereas sample players limit the user to factory supplied samples. The editing possibilities found in some sample players, however, allow the user enough flexibility in combining and modifying preset samples to create interesting new voices.

Which software?

The important decisions in buying music software will depend on what particular applications you will be covering within your music program. The major software categories have their own specific features to watch for. There are also a number of general considerations to keep in mind that apply to all software.

The User Interface:

An important factor to consider when purchasing software is the *user interface*. The user interface includes the way the internal organization of the program is represented to the user, the ways of invoking commands, selecting and entering data, and the kind of feedback offered the user. Having a program that can do everything you want is not enough if the user interface is awkward and difficult to learn.

If the program meets your needs in terms of what it can do, you should next consider:

User Interface Considerations

- **Flexibility of input**
  —Does the program allow input from either the keyboard or a mouse?
- **Quality of the screen display and graphics**
  —Is the screen easily readable or is it cluttered?
- **Response time**
  —Does the software respond quickly enough to user input?
  —Is disk access or screen refresh unreasonably slow?
- **Error handling**
  —Are error messages easily understood?.
  —Can the user recover 'gracefully' from errors or are they often 'fatal'?
- **Editing** (sequencers and notation/composition software)
  —Is the data represented clearly and intuitively?
  —Are the editing options adequate and easy to use?
- **Documentation**
  —Is the documentation clearly written, complete, and accessible?
  —Does the program provide 'on-line' help (provided within the program)?

Is the software appropriate for the grade level of your students?

It may be tempting for elementary music teachers to buy what is considered the 'state of the art' in music software, but buying the appropriate level of software is important in all the major software categories.

For most situations, extremely powerful, professional level sequencing or notation programs are not appropriate at the intermediate and junior secondary levels. The conceptual sophistication and complexity of many high-end programs may require from fifty to a hundred hours to learn completely, even for experienced users. Trying to teach even the bare necessities of some programs will take several hours of class time. If the amount of time needed to learn the program and the hardware is too great, the basic objectives of the activity may be lost.

Since there is usually a trade-off between program functionality and ease of use (as well as affordability), a program that fulfils your needs and is easy to learn may well be more useful than the top of the line professional program.

Composition: What will the final product be?

Compositions may be performed live by the students, or they may be recorded directly from a sequencer on to audio tape. If the composition is to be performed live from printed sheet music, then the notation capability of the software is very important. If, on the other hand, the final product of the composition is a sequenced recording, using only electronic instruments, then the flexibility and power of the sequencing features of the software will be more important than printed output.

It may be possible to find everything you need in one program-that is, a program that sequences and prints acceptable scores and parts, or it may be necessary to use more than one program to meet your needs. Fortunately, a standard MIDI file format has been developed which allows programs which support the standard to exchange files. You can then export files from your favorite sequencer to your favorite notation program.

Sequencer software checklist

There are now many sequencers on the market for all major computers. They offer many features and provide composers with flexible ways to create music. Although there are large differences between the look and operation of different sequencers, certain features are now expected in most of the current generation.

Sequencer Software Considerations

- **Graphic data display and editing**
  —Does it allow you to see notes in more than one type of representation, for example, an event list (alpha-numeric score), a piano role score, or in traditional notation?
- **Global editing features**
  Global editing refers to editing features that let you modify large areas (regions) of a composition at once. Typical global editing features include the ability to change:
  pitches -transpose, shift diatonically
  rhythms -quantize, 'humanize'
  key velocities -scale, limit, set
  strip continuous controller data -af tertouch etc.)
  —What kind of global editing features does the program have?
  —Can you set, scale and randomize most parameters?
- **Merging and unmerging**
  —Can you merge tracks from different channels and keep their original channel numbers?
  —Can you unmerge tracks?
- **Flexible quantizing**
  Quantization means to control the degree of rhythmic resolution of the notes in a track. There are many ways to quantize, for example:
  attacks only -control when notes start
  attacks and duration--also control note length
  humanize -add a slight random variation.
  —How easy and flexible is quantization?
  —Can you 'humanize' rhythms?
  —Can you 'undo' quantization?
- **Data filtering**
  —Data filtering can save memory if you do not need information such as aftertouch.
  —Can you automatically strip unwanted data from a recorded track?
- **Looping**
  Looping means to repeat a track a number of times. Some sequencers allow nested loops, that is, loops inside loops. Some also allow independent looping of tracks, loops with different starting and ending points.
  —Is it easy to set and remove loops?
- **Multiple channel recording**
  —Can you record from multiple sources on separate MIDI channels simultaneously?

Notation/composition software checklist

The number of programs that might be considered in this category is large. It includes programs that are simple and easy to use that might be appropriate for elementary use, as well as professional desktop music publishing software. The following checklist contains a number of questions you may ask before buying notation software.

Notation/Composition Software Considerations

- Does the program provide the necessary clefs, symbols and flexibility to meet your needs? Is there an adequate upper limit to the number of staffs it can provide? Can the user define graphic symbols to be used in the score or parts?
- Does the program space automatically? If so, can the user adjust the spacing easily?
- Does it automatically extract parts?
- Are there adequate high level editing functions? For example, can you: Copy, cut and paste? Add and delete slurs and articulations? Transpose? Change time and key signature within the score? Beam notes? Alter accidentals enharmonically?
- Page layout -Is there sufficient control of page size and printing format? Does it support more than letter and legal size paper?
- Can the user adjust screen objects by direct manipulation (for example, can the user grab and move a note by dragging it with a mouse) or does the program require specific keyboard commands for note by note editing?
- Does it have audio output? Does it support MIDI output? For most school applications audio and MIDI output are important.
- Is the quality of the printed output adequate for your needs? Does the program support PostScript printers? Can files be saved in Encapsulated PostScript (and be loaded into PostScript compatible graphics programs)?
- Can it save and load MIDI standard files? MIDI standard files provide a vendor independent format for saving MIDI data. Programs that support this format can therefore share files.

Can the software be networked?

Many of the secondary school computer labs are networked so that the computers can share resources such as printers, a hard disk and software. If an entire class will be working with the same program, it may be more convenient to have the software stored on the hard disk and accessed through the network. (Networking software does not eliminate the legal obligation to purchase a site licence or adequate copies of a program from the vendor.) Some programs contain copy protection mechanisms that prevent them from being networkable and therefore must be loaded from individual disks.

Other hardware

Along with the computer, several other pieces of hardware should be considered when setting up a computer music lab. The most important of these are the computer/ MIDI interface, the recording facilities and the printer.

Interface

An interface is necessary to connect a computer to a MIDI instrument. Interfaces can be simple, with one In, one Out and one Thru port, or they can be sophisticated, with multiple and configurable ports. Some interfaces are 'smart' in that they can do other tasks besides passing on the MIDI data such as provide data filtering and re-channeling, and even convert MIDI timing information to SMPTE time code. Many of the features would only be used in a professional studio. If your software needs or can take advantage of these features, then a deluxe interface might be appropriate, but in most cases, the simple variety will be adequate for educational purposes.

Recording facilities

The audio recording facilities that you will need may vary from a simple stereo reel-to-reel or cassette recorder, to a multitrack facility. Because MIDI sequencers can play at least sixteen MIDI tracks at one time, recording MIDI sequences may require no more than a good quality stereo tape recorder, and a mixer. Live vocals may even be be mixed with the MIDI tracks into a stereo recorder. If you have a multitimbral synthesizer with stereo output that provides all the sounds you need, you can even do without the mixer. More complex vocal and live instrumental arrangements may require a four or eight track recording system, in which case both the financial cost, and the cost in time needed to learn and teach the system, escalate.

Four-track cassette recorders can provide a flexible compromise between cost, flexibility, ease of use, and recording performance. Some four-track cassettes recorders record at the normal cassette speed and allow stereo as well as four-track recording, giving the user the flexibility of a live MIDI mix or overdubbing if necessary. Although the recording quality of most four-tracks recorders is only "demo" quality, in most situations it will be adequate for educational purposes.

Printers:

If you want to print out scores and parts from compositions and arrangements, you will need access to a printer that is compatible with your computer. If you are using a printer that belongs to the school's computer lab, you may have to ask a few questions.

Printer Considerations

- **Does the printer support graphics?**

  The printer you use for music must be able to support graphics as well as text, since notation programs usually print scores and parts with 'bitmapped' graphics. Most printers will support graphics, but some will need to have 'dip' switches set one way for graphics and another way for text.

- **Do you need a particular 'printer driver' for your printer?**

  A printer driver is a program that lets you print to a specific make and model of printer. Your school's computer contact person should be able to help you if the printer requires a particular driver.

- **Does your software support PostScript?**

  Postscript is a method of numerically encoding graphics and fonts used in many laser printers. Many music programs can support Postscript music fonts. For example, *Personal Composer*, *Professional Composer* and *Deluxe Music Construction Set* (using *Sonata* font by Adobe), and *Finale*, can support Postscript. The quality of printout from laser printers is far better than most dot-matrix printers and even approaches the look of professional type setting. If your software supports Postscript, find out if your district owns a laser printer.

Software Evaluations

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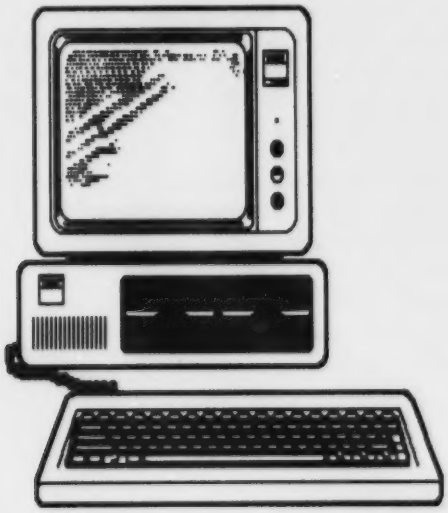

Band Room

Author:	S. Grant, R. Priddle, M. Russel	Evaluator:	Dr. Dallas E. Hinton
Publisher:	Music Master Software	School District #	39 (Vancouver)
Address:	PO Box 24476, Station C Vancouver, B.C. V5T 4E1	School:	David Thompson Sec.
		Address:	1755 E. 55th Ave. Vancouver, B.C. V5P 1Z7
Phone:	(604) 879-5277		
Supplier:	Music Master Software	Phone:	(604) 321-6741

Application type: **Database Management**
Version Reviewed: **N/A**
Hardware platform(s): **MS DOS, 256K, 1 drive, hard drive recommended**
Documentation: **105 page Users' Manual**

Description:

Band Room is designed for band directors. The program enables the director to store information on all aspects of instruments and related music equipment, including rental and repair details.

Specifically, *Band Room* allows data entry of fields such as make, model, type, serial number, case number, location, etc. The band director can track rental information, including to whom, rate, amount paid to date, balance due, etc. Results of searches can be viewed on screen or printed.

Band Room will handle approximately 400 reconrds on a floppy system or 25 000 records on a hard drive.

Strengths:

- employs very powerful search logic;
- allows easy recording of inventory;
- handles basic rental data, including limited accounting for rental payments;
- accepts large number of pre-coded instruments, and has space to customize;
- *Reference Librarian* program available to merge data from multiple sources (eg schools within a district);
- exports data in ASCII format;
- easy to use.

Weaknesses:

- no suggestions or command line prompts after incorrect entry of command;
- limited on-screen help (keep the manual handy unitl familiar with commands);
- slow to load using floppy disk system;
- cannot use multiple floppy disks for data;
- no DOS shell.

Evaluation Summary:

✓✓✓✓✓=excellent ✓✓✓✓=good ✓✓✓=acceptable ✓✓=poor ✓=unacceptable

Documentation	✓✓✓✓✓	
Performance	✓✓✓✓	
Error Handling	✓✓✓✓	
Ease of Learning and Use	✓✓✓✓	(limited on screen help)
Overall Value	✓✓✓✓✓	

Dallas' comments on *Bandroom*

Band Room is a music teacher's tool for recording, sorting, and printing information about a music department's inventory of instruments and equipment. It is essentially an ordinary database program, but has a number of features which make it unique.

To begin with, all the work of naming fields has been done; the fields are already labelled with "instrument" (using code numbers from a separate screen), "case number", "location", etc. There is space to indicate condition of the instrument, a notes field, and some rental information such as name, location, rate, and balance due (essentially a somewhat limited spreadsheet).

The main drawback to this program is the same as that of all databases; someone has to do the initial entry! Once that is done, however, the strengths of the *Band Room* become obvious. The teacher can quickly compile a list of, say, all clarinets which are not in the storage room. This list can be viewed on screen or printed, and will show the location of each instrument (including rentals).

The operation of the program is very straightforward, although the absence of command line prompts is a bit daunting at first. (It is probable that the next update will include such prompts). The program is easy to learn, with excellent documentation, and can be operated by a non-musician after only a small amount of initial training. The ease with which an up-to-date inventory can be produced is quite amazing to those of us who have been struggling with other methods for years.

Cakewalk

Author:	Greg Hendershott	Evaluator:	Allan Anderson
Publisher:	Twelve Tone Systems	School District #	38 (Richmond)
Address:	P.O. Box 226	School:	Matthew McNair Sr. Sec.
	Watertown, MA. 02272	Address:	9500 No. 4 Road
Phone:	(617) 924-7937		Richmond, B.C. V7A 2Y9
Supplier:	Annex Hi- Tech, Ward's	Phone:	(604) 274-7258

Application type: **Music Transcription**
Version Reviewed: **2.0**
Hardware platform(s): **MS -DOS, 384 K, 2 drive, Midi Interface**
Documentation: **95 page Users' Manual**

Description:

Cakewalk is a MIDI sequencer that lets you record up to 256 tracks of midi data from a synthesizer or other midi instrument and play it back. In many ways, it is similar to a multi-track tape deck. Unlike a tape deck, *Cakewalk* also provides sophisticated tools for manipulating your music.

With *Cakewalk* you can cut and copy sections of your music and paste them in new places. You can quantize rhythms, transpose pitches and velocities, and edit other MIDI parameters. You can also adjust the tempo, meter and key signature. This program is Microsoft-mouse compatible, using pull-down menus, short-cut keys and windows.

Cakewalk is an affordable professional sequencer for the IBM computer. The program lets you record, play back and edit 256 tracks of music using midi-equipped musical instruments.

Strengths:

- *Cakewalk* is a very clean and flexible sequencer. Although the editor does not offer all the features found in other sequencers, you can still do anything you need with little effort.
- The low price is a definite plus.

Weaknesses:

- In order to transcribe sequences to notation, you need to buy another program called Copyist II.
- The list display provided for editing events can be confusing at times.

Evaluation Summary:

✓✓✓✓✓-excellent ✓✓✓✓-good ✓✓✓-acceptable ✓✓-poor ✓-unacceptable

Documentation .....✓✓✓✓
Performance .....✓✓✓✓✓
Error Handling.....✓✓✓✓
Ease of Learning and Use ..✓✓✓✓
Overall Value .....✓✓✓✓✓

Allan's comments on *Cakewalk*

Cakewalk is a powerful and inexpensive sequencing program for DOS computers. It is really a second generation program that has adopted many Macintosh-like features such as pull-down menus, and mouse driven editing commands to cut, copy, and paste.

The program is very easy to learn for users at any level of expertise. My students don't need more than one class of instruction to get started. Once under way, the program is quite intuitive. The manual is more for occasional reference, which is the way it should be. The quality of the manual, however, is not up to today's high standard of desktop publishing. Students with poor eyesight will have trouble reading this manual.

The program offers 256 tracks on which one can record. I personally have never used more than thirty. Although 256 tracks seems a bit of an overkill, I guess it's nice to know that you can try several themes and variations of that jazz solo that you are trying to perfect.

I like the way that the commands are consistent for all of the windows when I am moving back and forth for editing. This certainly makes life easier when I'm in a hurry.

Cakewalk is not the most powerful sequencer around, but it is an excellent product for the money. The one major drawback to this program is that it does not have the capability of displaying or printing in traditional notation. You will have to buy a program like *Copyist* to notate any of your files.

Choir Master

Author:	S. Grant, R.Priddle, M. Russell	Evaluator:	Dr. Dallas E. Hinton
Publisher:	Music Master Software	School District #	39 (Vancouver)
Address:	P.O. Box 24476. STN. C	School:	David Thompson Sec.
	Vancouver, B.C. V5T 4E1	Address:	1755 East 55th Avenue
Phone:	(604) 879-5277		Vancouver, B.C. V5P 1Z7
Supplier:	Music Master Software	Phone:	(604) 321-6741

Application type: **Database Management**
Version Reviewed: **1.3**
Hardware platform(s): **MS DOS, 256K, 2 drive, recommend hard drive**
Documentation: **105 page Users' Manual**

Description:

Choir Master is designed especially for choral directors and librarians. It enables the director to store information on many aspects of a choral piece and allows searches using any or all of the database information. Search results may be displayed on screen or printed.

Choir Master allows data entry of fields such as Composer, Publisher, Title, File Number, Key, Editor, Voicing, etc. It also allows searches (positive and negative) on all fields. Results of searches can be viewed on screen, printed, or saved as an ASCII File.

Choir Master will handle approximately 500 - 700 records (floppy system) or 32,000 records (hard drive).

Strengths:

- customized to meet the needs of choir music librarians;
- very powerful search logic;
- easy entry of new information and/or revision of old information;
- NOT copy protected (easily installed on hard drive);
- "Reference Librarian" program available to merge multiple libraries (e.g. schools within a district);
- easy to use.

Weaknesses:

- incorrect commands are trapped, but no suggestions made;
- users must have documentation handy until very familiar with program;
- slow to load when using floppy sytem;
- cannot make use of multiple floppy disks for data (approx. 750 entries max on floppy system).

Evaluation Summary:

✓✓✓✓✓=excellent ✓✓✓✓=good ✓✓✓=acceptable ✓✓=poor ✓=unacceptable

Documentation .....✓✓✓✓✓
Performance .....✓✓✓✓
Error Handling.....✓✓✓✓
Ease of Learning and Use ..✓✓✓✓
Overall Value .....✓✓✓✓✓

Dallas' comments on *Choir Master*

Choir Master is a librarian's tool for recording, sorting, and printing information about a choral library. While essentially an ordinary database program, *Choir Master* has a number of features which make it unique. All the work of naming fields has been done; with labels like "title", "composer", "arranger", "last performance date", etc. There is space to indicate the voicing (number of soprano, alto, tenor, and bass parts), as well as room for the duration of the piece, and even the storage location.

The crowning touch, however, is the inclusion of fields which allow the librarian to indicate, among other things, the liturgical season of the piece (such as Christmas, or Easter), the period (Baroque, Renaissance, 50's), the affect (religious, humorous), the type (cantata, jazz), the accompaniment, the nationality, the languages used, any solos, and the performance history. There is also space for the number of copies of each piece, and space to record missing copy numbers.

The main drawback to this program is the same as for all databases: someone has to do the initial entry of all those pieces! Once that is done, however, the strengths of *Choir Master* become obvious. The librarian can quickly compile a list of, say, all pieces in the key of G Major which are for SSATB, are not more than 4 minutes long, and are not labelled as liturgical. This list can be viewed on screen or printed, and will also show the location of each piece (including loans).

Although the absence of command line prompts is a bit daunting at first, the operation of the program is straightforward, . The next update should include such prompts. The program is easy to learn, with clear documentation, and can be operated by a non-musician with a small amount of initial training. The ease of producing an up-to-date listing of choir pieces is quite amazing. The time saving will be most welcome to any music teacher, and especially to those with multiple responsibilities.

The Copyist Level II

Author:	Crispin Sion	Evaluator:	Dr. Dallas E. Hinton
Publisher:	Dr. T's Music Software	School District #	39 (Vancouver)
Address:	220 Boylston Street	School:	David Thompson Sec.
	Chestnut Hill, Ma. 02167	Address:	1755 East 55th Ave.
Phone:	(617) 244-6954		Vancouver, B.C. V5P 1Z7
Supplier:	Annex Hi-Tech	Phone:	(604) 321-6741

Application type: **Music Transcription**
Version Reviewed: **1.51**
Hardware platform(s): **MS DOS, 256K, 2 drive**
Documentation: **92 page User's Manual**

Description:

The Copyist Level II is an easy to use music transcription and score editing program. Scores can be created and edited directly on screen using the computer keyboard. Files may be interchanged with many sequencer programs including *Texture*, *Sequencer Plus*, *Master Tracks* and *Cakewalk*. Individual instrumental parts may be created from full scores.

Copyist consists of a number of seperate modules, each of which performs one operation. Any module may be accessed either from the main menu or directly from DOS. *Copyist* will run with only 256K but benefits from having 340K RAM, plus a RAMdisk. *Copyist* will handle up to 50 pages of full score.

Strengths:

- a tremendous saving of time and effort to produce printed music;
- quick transposition of parts;
- much more "user-friendly" than other transcription programs.

Weaknesses:

- quite slow when converting MIDI stream files or printing (dot-matrix);
- copy protected;
- difficult to learn.

Evaluation Summary:

✓✓✓✓✓=excellent ✓✓✓✓=good ✓✓✓=acceptable ✓✓=poor ✓=unacceptable

Documentation .....✓✓✓✓
Performance .....✓✓✓✓
Error Handling.....✓✓✓
Ease of Learning and Use ..✓✓✓
Overall Value .....✓✓✓✓

Dallas' comments on *Copyist*

Copyist is a score writing program which allows mouse or keyboard input to create a score and converts MIDI sequencer files (including *Texture*, *Sequencer Plus* and *Master Tracks*) to notation. In addition, *Copyist* scores may be converted to sequencer tracks.

Note ending quantization minimizes some of the problems associated with conversion, such as in *Personal Composer*. Keyboard mode allows notes to be entered quickly from computer keys acting as a piano keyboard. Dot-matrix print-out is of good quality but is a very slow process as with other similar programs. *Copyist* will write guitar tablatures and percussion staff with corresponding MIDI notes, (standard default, ie note #36 = snare drum), transposition, and full orchestral staff arrangements.

Using the program is quite straightforward, although it takes a while to become familiar with all the commands available. Most of the commands are logical (pe for erase page, s for a sharp sign, etc.) but a few are not (<ins> key to produce a vertical line to use in gauging vertical positions). I have had several students use the program with some success. They took quite a while to learn to use it, and never did finish producing all the parts from the score I had assigned them to input.

One of the biggest problems with *Copyist* seems to be an inability to handle changing time signatures. It is necessary to write each time signature section as a separate file, merge them, and then tidy up the joins by hand. Somewhat cumbersome, but still better than hand writing.

The other major problem occurs when transposing parts. *Copyist* is unable to correct the stem direction when a part has been transposed far enough to make that necessary. The program also moves the position of rests vertically. These problems means that there is quite a bit of manual correcting to do before the part is ready to print.

Despite these drawbacks, I feel that *Copyist* is the best transcription program available for MS-DOS systems at this time. It is manageable by advanced students and produces very good looking output even on a dot matrix printer. It simplifies much of the drudgery of transcibing parts, although it is not a great deal faster than a good hand copyist would be.

Personal Composer

Author:	Jim Miller	Evaluator:	Allan Anderson
Publisher:	Jim Miller	School District #	38 (Richmond)
Address:	P.O. Box 648	School:	Matthew McNair Sr. Sec.
	Honaunau, HI 96726	Address:	9500 No. 4 Road
Phone:	(808) 328-9518		Richmond, B.C. V7A 2Y9
Supplier:	Annex Hi-Tech, Ward's	Phone:	(604) 274-7258

Application type: **Music**
Version Reviewed: **2.0**
Hardware platform(s): **IBM, PC, XT, AT, or System 2, 640 K, hard drive**
Documentation: **607 page Users' Manual**

Description:

Personal Composer System 2 is a software package for computer users of all experience levels. It is intuitive and easy for the beginner, with maximum power and functionality for advanced composition, performance and even theoretical research.

Personal Composer is a complete system that integrates several music tools into one environment. Options include: score editing and playing; music printing and desktop publishing; 32 track midi recording; automatic transcription; MIDI graphic editing, MIDI event editing; performance options; universal librarian and DX/TX patch editing; and function key programming.

Strengths:

- Although *Personal Composer* does many things, the details are rarely sacrificed.
- Most commands are very specific, which allows flexibility for the seasoned user.
- Each area of the program is thorough, and the combination of them all offers exceptional power in one program.
- Computer programmers will enjoy this program.

Weaknesses:

- The cost of hardware can create some problems if you are on a limited budget. To make this program work properly you should have at least a 80286 processor, a mouse, a 20mb hard drive, an EGA card and an EGA monitor.
- The learning curve is quite steep - particularly if you don't know DOS.
- The sequencer is fairly weak.

Evaluation Summary:

✓✓✓✓✓=excellent ✓✓✓✓=good ✓✓✓=acceptable ✓✓=poor ✓=unacceptable

Documentation .....✓✓
Performance .....✓✓✓✓
Error Handling.....✓✓✓✓
Ease of Learning and Use ..✓✓✓
Overall Value.....✓✓✓

Allan's comments on *Personal Composer*

Until recently if you asked musicians what the best professional program for music was, they would probably say, "*Professional Composer /Performer*" for the Macintosh, and "*Personal Composer*", by Jim Miller, for DOS computers.

Personal Composer has been around for about 5 years now. It is very a powerful "all in one" program which includes a 32-track MIDI sequencer, a score editor, a graphic symbol editor, desktop publishing capability, and a DX7 patch librarian and editor. At first this sounds wonderful, but there is a price to pay for all this power. The program is not very user friendly and it is has some serious problems.

One problem is the way *Personal Composer* transcribes MIDI sequences into traditional notation. The end product (ie notation) that you see on the screen or print is just not that good. Although recording is very easy, when you go to the "Score" window to view your composition, it frequently doesn't resemble what you played. Even quantizing the data often does not adequately clean up the score.

The only way to see a composition written out as you would like to see it is to write it out one note at a time using the computer keyboard or a mouse. Using this method of data entry, the scoring capability of this program is quite powerful and flexibile. The sequencer, however, is fairly limited by today's standards.

In order to get the most value out of this program you need a hard drive, a mouse, and a colour monitor. Colour makes such a difference. You can colour code all of your commands and MIDI channels. If you have access to a laser printer you can do excellent desktop publishing. A fast dot-matrix printer works well too.

This program is definitely designed for advanced users. Programmers and hackers alike will really enjoy the Macro options available to them as well as the keyboard shortcuts.

Until recently, Jim Miller has had a monopoly in the DOS world for this type of comprehensive program. That has now changed with programs like *Finale* and *Mesa* being introduced. *Personal Composer* still has a lot of good features, but if it is to be useful to educators, it must be updated. I am certain that we will be seeing version 3.0 very soon. A lot of users are demanding it.

Practical Theory

Author:	Sandy Feldstein	Evaluator:	Dr. Dallas E. Hinton
Publisher:	Alfred Publishing Co., Inc.	School District #	39 (Vancouver)
Address:	15335 Morrison	School:	David Thompson Sec.
	Sherman Oaks, CA 91413	Address:	1755 East 55th Avenue
Phone:	(818) 891-5999		Vancouver, B.C. V5P 1Z7
Supplier:	Ward Music	Phone:	(604) 321-6741

Application type: **Music Theory**
Version Reviewed: **MS DOS**
Hardware platform(s): **MS DOS, 1 drive, DOS 3.2 or less; Apple IIE; Comm 64**
Documentation: **90 page Users' Manual**

Description:

Practical Theory is a CAI program to teach music theory. The 3 levels, with a separate workbook for each, can be purchased singly or together.

There are 84 lessons, with each fourth lesson being a review of the previous three. Students must demonstrate mastery learning by correctly answering ten consecutive questions to proceed to the next section. While no records are kept, there is a separate testing program available called *Music Achievement Series*.

The program first teaches the lines and spaces of the staff, and ends with harmonizing a minor melody. Topics include time and key signatures, rhythm, pitch, circle of fifths, dynamics, intervals and chords.

Strengths:

- Students enjoy the mastery learning approach and find it non-threatening.
- Material is covered thoroughly in small steps with good testing of comprehension every fourth lesson.
- A student workbook is also available.

Weaknesses:

- Students are not "looped back" to review an earlier lesson if they have problems at their current level.
- Operating instructions are non-existent.
- The teachers' guide is the same for all three computers supported..
- Disks are copy protected.
- In the MS DOS version, a colour card is required. The program may run using "SIMCGA", depending on the computer.

Evaluation Summary:

✓✓✓✓✓-excellent ✓✓✓✓-good ✓✓✓-acceptable ✓✓-poor ✓-unacceptable

Content .....✓✓✓✓✓
Instructional Quality.....✓✓✓✓
Technical Quality .....✓✓✓✓

Dallas' comments on *Practical Theory*

Practical Theory is a three-level program (2 disks per level) which comes with an accompanying workbook and instructors' manual. Individual student workbooks are available separately, but are not essential to the learning process. The program uses a Mastery Learning approach, requiring the student to successfully answer 10 questions consecutively before permitting continuation to the next unit. No records are kept, so the student isn't under pressure to continue.

Each unit consists of some screens which simply state information to be learned, and some which require a correct response to a question. In all cases, the program does not continue until the student indicates readiness.

Where appropriate, the actual notes being shown on screen are also played, either by the computer speaker, or by an attached MPU-401 MIDI interface and synthesizer. In the latter case, some answers can be given by playing on the synthesizer.

I have been using *Practical Theory* and the companion *Achievement Series* for 3 years now, and have found that students have become quite willing to learn theory. They seem to find the computer program an enjoyable, non-threatening experience, and in some cases, have to be prevented from deliberately forgetting their instrument in order to use the computer!

Following the same pattern as *Practical Theory*, the *Achievement Series* uses a password for each student to ensure privacy (there is, of course, a teacher's password which overrides all others) and tracks the student's responses. Interestingly, students are allowed to redo a test, and the program records only the last mark attained (reinforcing the concept of Mastery Learning).

The major drawback to this program is the copy-protection scheme. No backups are possible, although the potential for damage and loss is very high if there are large numbers of students involved. The company has offered to allow users to purchase one extra set of disks for $10 each, but this is not really an adequate solution to the problem, and amounts to paying an extra $60 for the program.

Because of the copy protection scheme in use, the program disk is self-booting. This requires that the user copy the file "command.com" onto the original program disk, and prevents the user from changing to another level of the program without first turning the computer off and back on. No instructions for this copying are included with the documentation; in fact, the documentation does not differ among the three computer types supported (MS-DOS, Apple IIe, and C-64).

Another drawback to *Practical Theory*, at least in the MS-DOS version, is that a colour screen and card are required. I have had some success using the free "*SIMCGA*" program available from some computer bulletin boards, but this solution doesn't work on all computers (notably the Commodore PC10 series).

Despite these disadvantages, the program meets the needs of the music program, assisting students in learning, fairly painlessly, the language of music to an advanced level.

Texture II

Author:	Roger Powell	Evaluator:	Dr. Dallas E. Hinton
Publisher:	Magnetic Music	School District	#39 (Vancouver)
Address:	RD 1 North Smith Road	School:	David Thompson Sec.
	LaGrangeville, N.Y. 12540	Address:	1755 East 55th Avenue
Phone:	(914) 677-8586		Vancouver, B.C. V5P 1Z7
Supplier:	Annex Hi-Tech	Phone:	(604) 321-6741

Application type: **Music - MIDI Sequencing Program**
Version Reviewed: **2.5G**
Hardware platform(s): **MS-DOS, 256K, 1 drive**
Documentation: **129 page Users' Manual**

Description:

Texture is designed to record MIDI information, either directly from a synthesizer or by computer-keyboard input, and play back that information to any MIDI equipped device. The program enables the user to edit the recorded information for pitch, duration, volume, and speed. *Texture* also allows the user to link "patterns" into a "song" in the same way that a word processing program links paragraphs into an essay.

Notes are recorded into patterns, with up to 96 patterns of arbitrary lengths up to 999 beats. Then patterns are linked together to create songs, up to 2304 independent sequences and 99 links. Every command can be usued even while music is playing, and all 16 MIDI channels may be controlled simultaneously. *Texture* makes maximum use of all RAM available (up to 640K for a capacity of approx. 72,000 notes).

The program is menu driven with one keystroke power commands, and includes an undo command and full editing capabilities. *Texture* will sync to tape, works with SMPTE, and includes programmable ritard and accelerando.

Strengths:

- most commands are intuitive and obvious.
- learning curve is very short.
- program works well at all levels from beginners to professional studio applications.
- allows real-time or step-time recording.
- 24 tracks, 16 midi channels, filtering.

Weaknesses:

- copy protected.

Evaluation Summary:

✓✓✓✓✓-excellent ✓✓✓✓-good ✓✓✓-acceptable ✓✓-poor ✓-unacceptable

Documentation .....✓✓✓✓
Performance .....✓✓✓✓✓
Error Handling.....✓✓✓✓
Ease of Learning and Use ..✓✓✓✓
Overall Value .....✓✓✓✓✓

Dallas' comments on *Texture II*

This very powerful sequencer is an absolute delight to operate! The commands are completely obvious (*p* for play, *r* for record, etc.) and there is an on-screen command reminder if needed (alt- H). All MIDI parameters can be seen and changed, and it seems impossible to get ahead of the system, even on a 4.77 MHz XT.

My students have been using *Texture* for over 2 years, and have progressed to teaching others. Within only a few hours, students can operate the program fluently and comfortably, producing good quality work within the limitations of the particular student's musical maturity.

Texture does not use traditional music notation, but within an individual track displays each note as a single line, showing the beat count, pitch, volume, and program change (patch change) or note on/off. Beats are divided into 22 sub-beats, with each sub-beat further divided into 5 sub-sub-beats. Changes can be quickly made to any element simply by typing the new value over the old. There is an "Undo" command to restore the last change.

Perhaps the most interesting aspect of *Texture* is the use of "patterns" and "links". The program allows construction of songs in the same way that one writes an essay. The composer writes a collection of patterns and then links those patterns together in any way he chooses. If the result is not what was wanted, it is very easy to change the order or to insert or delete patterns. The finished group of patterns linked together is called a song.

Both patterns and songs may be saved, so that it becomes easy to build a bank of tune fragments with which to build new works. In addition, each pattern can be transposed, repeated, and/or have tempo changes (abrupt or gradual).

I have no hesitation in recommending *Texture*. It is not just an easy program for students and teachers to learn and to use; it is also more than powerful enough for professional studio use.

Apple II GS

Pyware Instrument Designer 78

Pyware MusicWriter 80

Pyware Instrument Designer

Author:	Pygraphics	Evaluator:	Martin Summers
Publisher:	Pygraphics	School District #	35 (Langley)
Address:	P.O. Box 639	School:	Aldergrove Secondary
	Grapevine, Texas 76051	Address:	26850 29th Avenue
Phone:	(817) 481-7536		Aldergrove, B.C. V0X 1A0
Supplier:	Peripheral Designs	Phone:	(604) 856-2521

Application type: **Instrument design utility**
Version Reviewed: **1.0**
Hardware platform(s): **Apple II GS, 512 K, 1 drive, external speaker**
Documentation: **66 page Users' Manual**

Description:

Pyware Instrument Designer makes use of the Apple IIGS ensoniq synthesizer chip to create sound which can be used with *Pyware MusicWriter*. This program allows the to control many sound parameters. *Instrument Designer* can be used to create "acoustic" instruments as well as original sounds.

Instrument Designer allows you to see and hear how modifications to sound waves affect the sound. Students and teachers involved in music and science will be able to make good use of this program.

Strengths:

- a well developed graphic user interface.
- good sound quality.
- comes with an extensive library of sound and wave files.
- powerful sound editing capabilities.

Weaknesses:

- no tutorial
- slow screen refresh

Evaluation Summary:

✓✓✓✓✓=excellent ✓✓✓✓=good ✓✓✓=acceptable ✓✓=poor ✓=unacceptable

Documentation .....✓✓✓✓✓
Performance .....✓✓✓✓
Error Handling.....✓✓✓✓
Ease of Learning and Use ..✓✓✓✓
Overall Value .....✓✓✓✓✓

Marty's comments on *Instrument Designer*

Instrument Designer, by Pyware, enables students to work with a variety of sound parameters to modify existing "instruments" and create new ones.

Instrument Designer uses graphic windows to modify sound waves. The windows include

- vibrato,
- volume de-tuning,
- envelope, and
- a graph of the actual sound wave.

One or two waves can be played back singularly, or looped using the keyboard window.

Using these graphic windows, the student can edit

- sound waves,
- attack,
- sustain,
- decay,
- release (ADSR),
- vibrato,
- pitch bend,
- volume,
- de-tuning,
- wavesize, and
- relative pitch.

The File menu has the usual commands (minus print - this program does not print) plus a "library" (move file to library) and a "get wave field" command, (digitized wave file). The Edit menu is standard, including an "undo" command (not yet usable in this version).

Various menus give the student considerable control over sound parameters.

- The **Windows menu** opens each of the five main graphic windows.
- The **Envelope menu** allows you to open, revert, and/or exchange a snapshot of the envelope of the sound (ADSR). Once open you can modify the wave (drawing, cut and paste etc.).
- The **Option menu** allows you to see the whole wave or a part of it, alter the pitch, alter the wave size, alter playback, (looped A & B, one-shot A & B, or one shot A/looped

Instrument Designer is an excellent utility for creating new instruments for use with *MusicWriter*, and a useful tool for an instructional unit on sound.

Pyware MusicWriter

Author:	Pygraphics	Evaluator:	Martin Summers
Publisher:	Pygraphics	School District #	35 (Langley)
Address:	P.O. Box 639	School:	Aldergrove Secondary
	Grapevine, Texas 76051	Address:	26850 29th Avenue
Phone:	(817) 481-7536		Aldergrove, B.C. V0X 1A0
Supplier:	Peripheral Designs	Phone:	(604) 856-2521

Application type: **Music Notation and Composing**
Version Reviewed: **1.3 Level 1**
Hardware platform(s): **Apple IIGS, 768 K, 1 drive, mouse**
Documentation: **105 page Users' Manual, Disk**

Description:

MusicWriter allows the student to write, copy, merge, sequence and transpose music, printing full scores and parts. With the Apple IIGS's built in ensoniq synthesizer chip the student can hear a composition instantly (up to 15 voices simultaneously). An Apple MIDI box allows the program to connect to an external synthesizer, providing more flexibility and features.

MusicWriter comes in three levels, Level One (three staves), Level Two (six staves), and Level Three (32 staves). Each level has the same features; the only difference is the number of staves you are able to work with.

Strengths:

- the most comprehensive music program written for the Apple IIGS, with virtually everything needed to compose and print;
- excellent output on an Imaagewriter II.

Weaknesses:

- very few jazz symbols;
- beams are all horizontal;
- MIDI input could be better;
- speed of Apple II GS sometimes makes graphic screen refreshes slow;
- long boot-up time.

Evaluation Summary:

✓✓✓✓✓=excellent ✓✓✓✓=good ✓✓✓=acceptable ✓✓=poor ✓=unacceptable

Documentation .....✓✓✓✓✓
Performance .....✓✓✓✓
Error Handling.....✓✓✓✓✓
Ease of Learning and Use ..✓✓✓✓
Overall Value .....✓✓✓✓✓

Marty's comments on *MusicWriter*

With *MusicWriter*, music can be input with a MIDI compatible synthesizer or a mouse. The program has all the standard "file" menu items including a *file compact* command. Editing features are standard plus *shift, transpose, invert, align notes, realign notes*. Notes can be beamed, tupled (any kind), augmented and diminished.

An unusually wide variety of music symbols can be placed anywhere on screen. The four standard clefs are available. All the key signatures and any time signatures can be entered when needed. *MusicWriter* includes automaic barring, error checking, and stem changing during transposition. Stems can be automatic or set; tempo is variable.

Sixteen different instrument sounds are available, and others can be loaded from other sources (*Pyware Instrument Designer*). The composer controls staves, leger lines, notation style, labels, headers, footers, lyrics, text (in any GS font), braces, brackets, and bar groupings. MIDI output is available.

With the introduction of *MusicWriter*, roughly equivalent to *Deluxe Music Construction Set* for the Macintosh and the Amiga, the Apple IIGS can now be used to write music — input by mouse or MIDI keyboard — and print music — up to a full 32-staff score! The quality of the printed music is very high on a dot matrix ImageWriter II printer and even better on a LaserWriter.

While composing, the student can at any time have the computer play the composition, with as many as 15 different notes with 15 different timbres at one time. The software assigns one sound per staff, so with 15 staves, each with one line of music, *MusicWriter* allows the student to hear 15 different sounds at THE SAME TIME!

There are any number of ways to use *MusicWriter*. My wife is an elementary music specialist who, among her many other jobs, teaches grade six and seven concert band. Our school district holds a festival every Spring which showcases soloists and small ensembles. I had just arranged the main theme from Brahms' First Symphony, last movement, for clarinet trio to use with two of my private clarinet students, when my wife (after hearing the computer play the composition) asked if she could use the trio at school for the solo and ensemble festival. I said "Sure."

Then she asked if I could rewrite it for two clarinets and French horn. In ten minutes I had a printed copy of the "new" trio for two clarinets and French horn.

My wife came home the next afternoon and told me the horn player, who had a conflict, had been replaced by a trombone player. No problem, — another ten minutes and I had a "newer" trio.

Two days later, my wife matter-of-factly informed me that the horn player was back in the group as he could, now, make it to the festival. This time it took me twenty minutes to add a fourth part and print out the "newest" quartet.

With some practice, I find that mouse entry is as fast as writing the music by hand. The best part is transposition. In only ten seconds, the computer can turn a "C" treble clef part into a piece of music for any jazz combo instrument.

Macintosh

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Deluxe Music Construction Set

Author:	Geoff Brown	Evaluator:	Brian Fairholm
Publisher:	Electronic Arts	School District #	44 (North Vancouver)
Address:	1820 Gateway Drive	School:	Braemar Elementary
	San Mateo, CA 94404	Address:	3600 Mahon Avenue
Phone:	(415) 572-2787		North Van., B.C. V7N 3T6
Supplier:	Byte Computers	Phone:	(604) 988-6308

Application type:	**Composition Program**
Version Reviewed:	**2.5**
Hardware platform(s):	**Macintosh, 512K, 1 drive**
Documentation:	**132 page Users' Manual**

Description:

Deluxe Music Construction Set (*DMCS*) is a graphically oriented composition program that can be used to print scores and parts or to play and record compositons. Up to four voices can be played using the Macintosh's sound capability and an unlimited number of voices can be played through a MIDI instrument.

The notation features of *Deluxe Music Construction Set* include up to thirty-two staffs, alto, tenor, treble and bass clefs, note beaming (user modifiable beam angles), direct manipulation of notes, rests, bar lines, slurs, crescendos and decrescendo, lyric capability in any fonts and laser printer support.

DMCS performance features include MIDI input in step-time, output on sixteen MIDI channels,and real-time program changes.

DMCS will be useful for many grade levels but lacks some features of professional level notation programs.

Strengths:

- excellent graphic interface;
- flexible note entry;
- many keyboard command shortcuts;
- contains many useful editing features.

Weaknesses:

- does not save in standard MIDI file format;
- lacks a global "enharmonic" function;
- limited print formatting capability;
- no automatic part extraction.

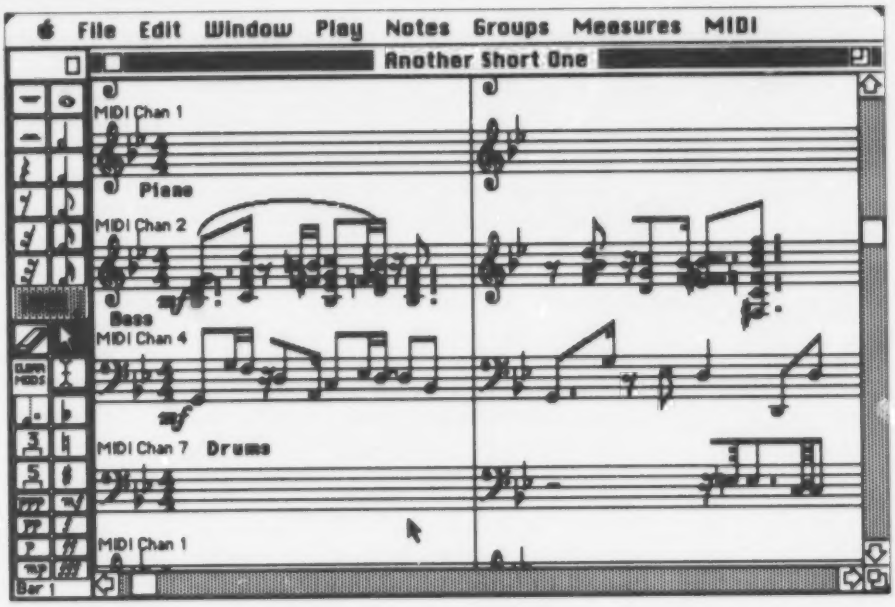
Evaluation Summary:

✓✓✓✓✓=excellent ✓✓✓✓=good ✓✓✓=acceptable ✓✓=poor ✓=unacceptable

Documentation	✓✓✓✓✓
Performance	✓✓✓✓
Error Handling	✓✓✓✓✓
Ease of Learning and Use	✓✓✓✓✓
Overall Value	✓✓✓✓✓

Brian's comments on *Deluxe Music Construction Set*

Most students find *DMCS* an easy program to learn and use. The graphic interface is one of the best found in any music program. Entering music is handled by simply grabbing musical symbols from the note palette and clicking the mouse at the appropriate location on the staff. Keyboard shortcuts can be used for most of the program's functions so that note entry and editing can be quite quick. The program's editing functions are moderately powerful, and in most cases, intuitive and well thought out.



DMCS is an excellent tool to use to teach composition, particularly in a classroom situation. Because the program can use the sounds from the Macintosh as well as MIDI instruments, a lab of computers can be used with no hardware expense beyond a class set of headphones. Student compositions can be taped directly from the Macintosh.

Better quality recordings can be made, however, if one computer is set up as a recording station. It should have a second disk drive so that student files can be loaded easily, and a MIDI interface connected to at least one sound source (preferably multitimbral). With access to a lab of Macintosh computers, a lab set of *DMCS* software, and under $2000 of sound equipment, an entire class can work at one time.

Both the playing and the printing capability of *DMCS* are certainly adequate for elementary and secondary needs. I have even found the program useful for teaching arranging and jazz theory at the college level. Teachers can use this program to arrange and print vocal and small ensemble pieces for performance classes.

With up to thirty-two staffs, *DMCS* can be used for stage band and concert band compositions and arrangements, but its limitations begin to show. Important editing functions are missing. Control over the look and layout of the score and parts is limited. When one compares *DMCS* to the more expensive notation programs such as *Finale* and *Professional Composer*, its printing limitations become obvious. However, in term of value for the dollar as an educational tool, there are currently few music programs that can rival *Deluxe Music Construction Set*.

FINALE

Author:	listed below	Evaluator:	Brian Fairholm
Publisher:	CODA Music Software	School District	#44 (North Vancouver)
Address:	1401 E. 79th St.	School:	Braemar Elementary
	Bloomington, MN 55425	Address:	3600 Mahon Avenue
Phone:	1-800-843-1337		North Van., B.C. V7N 3T6
Supplier:	Ward Music	Phone:	(604) 988-6308

Application type: **Notation/Transcription and Sequencing**
Version Reviewed: **1.0**
Hardware platform(s): **MacIntosh, 2 drive (1hard drive)**
Documentation: **3 spiral bound manuals, 1 hypercard disk**

Description:

Finale is a sophisticated notation/transcription and sequencing program aimed at the professional desktop music publishing market. It is a complex program and requires a great deal of time and patience to learn. Once mastered, *Finale* offers the greatest functionality and flexibility of the notation programs for the MacIntosh.

Finale allows the user several alternative modes of note entry including graphic entry using the mouse and note icons, quick entry from the MacIntosh keyboard, and flexible real-time entry. One method of entry lets the user play with rubato timing and then tap in the beats separately.

Users can customize many aspects of the program for their own particular needs and composition style. Graphic symbols can be created by the user.

Strengths:

- very powerful score and part formatting features;
- very flexible methods of note input;
- supports macros;
- supports user created graphics;
- contains user definable functions.

Weaknesses:

- difficult to learn;
- slow screen refresh;
- documentation is complete, but difficult to navigate.

Authors:

Evaluation Summary:

✓✓✓✓✓=excellent ✓✓✓✓=good ✓✓✓=acceptable ✓✓=poor ✓=unacceptable

Documentation .....✓✓✓✓
Performance .....✓✓✓✓✓
Error Handling.....✓✓✓✓✓
Ease of Learning and Use ..✓✓
Overall Value .....✓✓✓✓

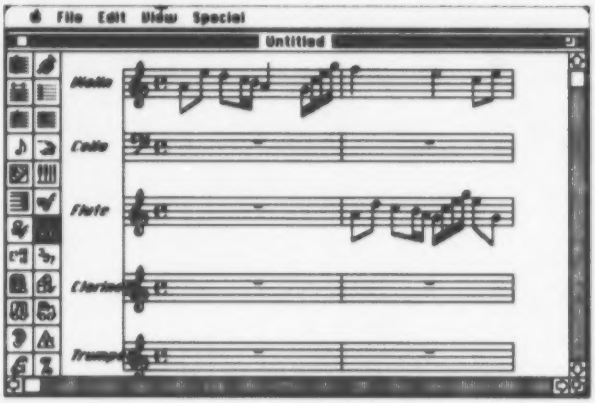
Brian's comments on *Finale*

Finale has received a great deal of attention since it appeared on the market in 1988. It was initially heralded as the ultimate music processor and the answer to a musician's dream. It has since received more cautious reviews from a number of magazines whose reviewers have taken time to learn and work with the program. The reviewers at *Keyboard* magazine worked with the program for three months and felt they still had not mastered every aspect of it. *Finale* is a complex and powerful program aimed at the professional musician.

The list of *Finale's* attributes is very long and impressive, including: five modes of step-time note entry, flexible real-time recording, PostScript compatibility, complex time signatures, text import and export, eight predefined clefs, chord analysis,128 staves and 32,768 measures (memory permitting).

Finale represents many program functions as specialized tools rather than as menu items. The entire tool palette is too large to be seen at one time on a Mac plus or SE screen. The palette must be scrolled to view the missing tools. Fortunately, tools can be rearranged by the user into other configurations. The emphasis on so many tools with a specific function gives *Finale* a very modal feel. The user must always keep in mind what tool is current and what can be done with that tool. This is particularly frustrating in the two modes of graphic note entry, neither of which is as easy or intuitive as *Deluxe Music Construction Set.*

I would appreciate a more general pointer tool that could be used to select data regardless of the intended operation. Configurable menus would be useful in such a large program. For example, the ability to assign the functions of tools to a tear-off menu (with keyboard short cuts) could help reduce the clutter of tools. Many of *Finale's* problems are being addressed in version 2.0, expected in the Fall of 1989.



Finale is probably as complex as any program currently being sold for microcomputers. Part of the difficulty of using *Finale* is a necessary consequence of its power and complexity. It could, however, have been designed to give the user an easier time in the initial stages.

Finale may be useful in advanced composition programs (grade 11-12 or post-secondary) where students have a fair amount of experience with MIDI equipment and software. Navigating through the numerous options and tools requires guidance beyond the manuals and Hypercard tutorial provided by Coda. Any teacher intending to use this program should be prepared to spend many hours (weeks) learning it and then carefully plan which features to use and how to introduce them.

Jam Factory

Author:	David Zicarelli	Evaluator:	Rob Turner
Publisher:	Intelligent Music	School District #:	(41) Burnaby
Address:	P.O. Box 8748	School:	Forest Grove
	Albany, N.Y. 12208	Address:	8525 Forest Grove Drive
Phone:	(518) 434-4110		Burnaby, B.C. V5A 4H5
Supplier:		Phone:	(604) 420-3619

Application type: **Computer Music**
Version Reviewed: **n/a**
Hardware platform(s): **Macintosh, 1 drive, MIDI interface**
Documentation: **7 page Demo Manual, Demo Disk**

Description:

Jam Factory is a 4 track interactive composition program which makes extensive use of computer generated aleatoric variation to user input (pitch and rhythmic data). The range over which this material can be varied is graphically controlled by clicking and dragging the mouse to change values. The output is a midi date stream,, driving synthesizers which produce the sounds.

Jam Factory accepts MIDI input in real time and allows editing of this input data in step time. It also allows control over parameters which specify ranges over which the program can vary the original input. For example: pitches can be changed or remapped; durations can be altered; accent patterns can be specified and legato and staccato rules can be applied.

Jam Factory allows the recording and subsequent simultaneous replay of up to four discrete parts. The relationship between these parts and within any one part can be altered in real time. New input data can be added to any part at any time.

Strengths:

- provides users (students) with the opportunity to experience non-deterministic real time composition;
- allows hands on experience with different structures and transformations than one normally listens to or plays.

Weaknesses:

- The vocabulary and concepts (eg. Markov Chain) tend to be advanced. However, with proper documentation, and in the context of a course in computer music compositon, it could be introduced properly and adequately reinforced.

Evaluation Summary:

✓✓✓✓✓=excellent ✓✓✓✓=good ✓✓✓=acceptable ✓✓=poor ✓=unacceptable

Documentation .....✓✓✓
Performance .....✓✓✓✓
Error Handling.....✓✓✓
Ease of Learning and Use ..✓✓✓
Overall Value.....✓✓✓✓

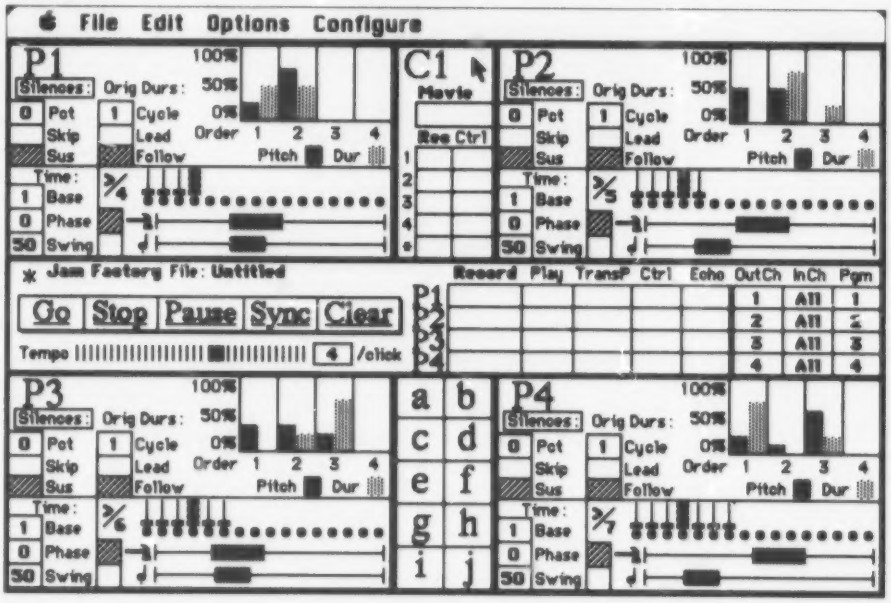
Rob's comments on *Jam Factory*

Jam Factory provides an opportunity for experimentation with less deterministic approaches to composition than most sequencing software. When MIDI data is input into any one of four "players" (tracks), students "learn" to make intelligent and hopefully musical variations. The data is placed in a Markov chain which allows the probability of subsequent events to be affected by the previous events in the chain.

While *M* is pitch hierarchical in focus, *Jam Factory* retains both pitch and timing information. Original durations may be used, or the composer can choose a mode called "silences", in which stochastic skips in the rhythm are introduced and controlled by a user specified percentage range. The subsequent notes can either be left out or delayed by choice. Also, a swing feature enables the user to specify the percent of swing, like most drum machines. The pitch choices are related to the input pitches and can be continuously altered by the input of more pitch material.

An accent pattern is graphically displayed and can be easily altered, providing interesting effects with velocity sensitive patches. A range may also be specified for random legato or staccato variations. This control of articulation is very effective for radically changing the quality of the output of the various Players individually

Changes in performance, such as tempo, can be made from a MIDI keyboard. Material can be copied from one player to another by the use of the clipboard and commands (eg. paste pitches) from the edit menu. However, some of the controls are small and difficult to see and use. There is no feature (as in *M*) that allows these controls to be expanded in other windows.



The settings of the Players and the Control Strip may be stored as presets which can be accessed with a click later, similar to the snapshot feature in *M*. Again, as with *M*, scales (pitch sets) may be distorted or remapped onto other pitch sets. Music teachers who wish to offer alternative approaches to composition may wish to consider *Jam Factory*.

Listen

Author:	Greg Jalbect	Evaluator:	Allan Anderson
Publisher:	Resonate	School District #	38 (Richmond)
Address:	P.O. Box 996	School:	Matthew McNair Sr. Sec.
	Menlo Park, C.A. 94026	Address:	9500 No. 4 Road
Phone:	(415) 323-5022		Richmond, B.C. V7A 2Y9
Supplier:	Ward's, Annex, Byte Com	Phone:	(604) 274-7258

Application type: **Music - Ear Training Software**
Version Reviewed: **2.0**
Hardware platform(s): **Macintosh, 1 drive**
Documentation: **86 page Users' Manual**

Description:

Listen allows high school and college students to improve their listening skills through interaction with the Macintosh computer. A working knowledge of how a Macintosh works as well as an understanding of music theory is required.

Listen provides a way for the student to develop listening skills interactively with the Mac in a specially designed learning environment. A *piano keyboard* and a *guitar fretboard* may be used with the mouse for input. *Listen* is also fully MIDI compatible.

With *Listen* you can change the level of difficulty to any of 5 levels - each having several options.

Strengths:

- ease of use;
- reasonable price;
- MIDI capabilities;
- use of graphics;
- advanced users will find it quite a challenge, especially when using inversions of 9th, 11th and 13th chords.

Weaknesses:

- lacks rhythmic and basic music notation exercises;
- site license currently not available for schools;
- lacks a record keeping system for teachers.

Evaluation Summary:

✓✓✓✓✓-excellent ✓✓✓✓-good ✓✓✓-acceptable ✓✓-poor ✓-unacceptable

Content .....✓✓✓✓
Instructional Quality.....✓✓✓✓
Technical Quality .....✓✓✓✓

Allan's comments on *Listen*

Listen is the original ear-training program for the Macintosh computer. I have used this program for three years now with reasonably good results. The program is designed to be used by serious music students who wish to improve their listening skills.

Many options are available to the user including:

- single notes,
- two-note melody,
- growing melody,
- melody,
- intervals,
- riads,
- 7th/9th/11th/13th chords (only 4 notes play at a time),
- random atonal chords,
- triad inversion naming, and
- 7th chord inversion naming.

Listen also gives the student many options such as range (up to more than five octaves), available notes and inversions, arpeggiated chords, and melody length.

A progress bar is present for each exercise, but unfortunately, only the progress on the current exercise is displayed. The window options available include a piano keyboard, a guitar fretboard, a timer, and a notation primer (for those who want to see what is really being played). This program is fully compatible with a MIDI keyboard.

Listen is quite valuable for individual and class use (in a computer lab). The major weaknesses of the program are its omissions. *Listen* does *not* have the following features: instructional material for learning theory, rhythmic notation, chord progressions, a way to keep track of student progress, or a way, as of yet, to buy a site license. The program is copy protected with a key disk.

This program is very easy to learn and the graphics are well laid out. The sound output is quite reasonable especially when listened to through a pair of headphones.

M

Author:	David Zicarelli	Evaluator:	Rob Turner
Publisher:	Intelligent Music	School District #	41 (Burnaby)
Address:	P.O. Box 8748	School:	Forest Grove
	Al.bany, N.Y. 12208	Address:	8525 Forest Grove Drive
Phone:	(518) 434-4110		Burnaby, B.C. V5A 4H5
Supplier:	Saved By Technology	Phone:	(604) 420-3619

Application type: **Computer Music**
Version Reviewed: **1.0 (demo version)**
Hardware platform(s): **Macintosh, 1 drive, MIDI interface**
Documentation: **Disk, Demo Manual**

Description:

M is a flexible 4 track MIDI sequencing program that allows experimentation with aleatoric (randomly generated) composition process in computer assisted composition. Ranges of variation are specified by the user, and the computer then alters pitch, tempo, volume, timbre and rhythmic information within these limits.

M generates automatically and continually varying controls for transposition, MIDI routing, volume, rhythmic characteristics and legato or stoccato properties of any one of four patterns (MIDI tracks). While using *M* the user has control over the range of variation of any of the above.

All of the program settings can be saved in files (snapshots) to be recalled later. Many changes can be made with the mouse in real time, as the program is replaying and/or recording MIDI data.

Strengths:

- *M* allows students to experiment with computer-assisted aleatoric composition
- The student can control ranges of variations;
- Ideas and processes of composition arise that one doesn't encounter in more usual deterministic ways of composing.

Weaknesses:

- Insufficient documentation of the demo version available for review leaves many questions unanswered about aspects of the full program work.
- Many of the controls seem global, rather than affecting the 4 tracks individually.

Evaluation Summary:

✓✓✓✓✓-excellent ✓✓✓✓-good ✓✓✓-acceptable ✓✓-poor ✓-unacceptable

Documentation .....✓✓✓
Performance .....✓✓✓✓
Error Handling.....✓✓✓
Ease of Learning and Use ..✓✓✓
Overall Value .....✓✓✓✓

Rob's comments on *M*

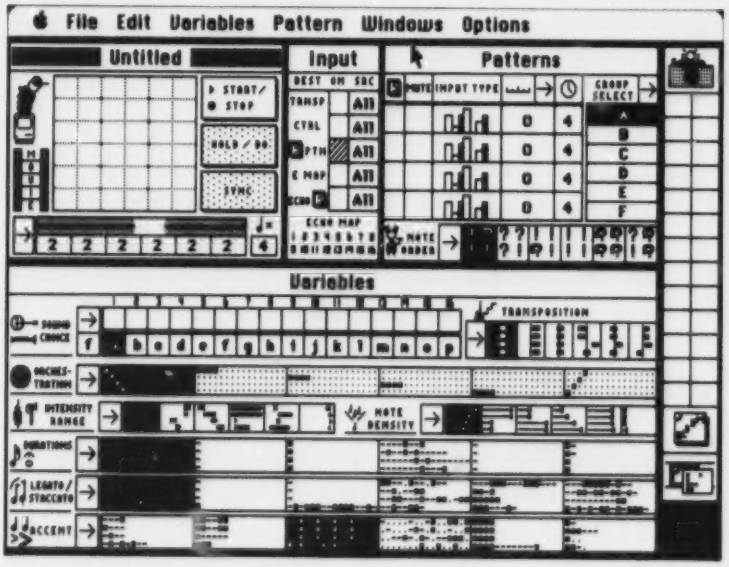
M, by Intelligent Music, was one of the first algorithmic composition programs to appear for personal computers and it remains one of the most popular. The program allows the user considerable freedom to experiment with aleatoric processes in computer assisted composition and performance.

Pitch data is entered from a MIDI keyboard and can be edited manually. Further transformation of the data is done by the computer in real time, according to parameters set by the user. The results can vary from mild variations of the original material to surprising novel sounds.

Computer generated variations of input data can be heard shortly after arrival at the main screen. The pitch variations can prove very interesting, especially when coupled with changing accent patterns, note density control, and legato/staccato variations. The program seems pitch hierarchical though, and, unfortunately, the rhythmic variety seems to suffer.

MIDI channel assignment, patch program information, and MIDI-echoing can be easily accessed and manipulated from the main screen. The variables window, at the bottom of the screen, allows control of transposition, orchestration (MIDI channel and patch values), intensity range, note density, durations, legato/staccato, and accent variability ranges. Although the main screen is crowded, double clicking on most control boxes will open a window with the same control, but much larger to facilitate adjustment.

There are a variety of ways to record a pattern including the usual step time and real time. Pitch distribution, which counts the number of occurrences of a pitch, and cyclic pitch distribution, which is similar to drum machine recording, are two other possible recording modes. Pitch sets can be remapped onto other pitches and these can be recalled during playback.



Another useful function is the possibility of taking a snapshot of the screen at any one time and saving it, to be replayed later in conjunction with others. This allows easy construction of freely changing yet well differentiated sections.

M is an interesting program, both as a teacher resource and as an alternate approach for advanced music students at the high school level. Anyone interested in the controlled use of aleatoric processes in composition and performance will be able to make good use of this program.

Ovaltune

Author:	David Zicarelli	Evaluator:	Brian Fairholm
Publisher:	Intelligent Computer	School District #	44 (North Vancouver)
Address:	116 North Lake Avenue	School:	Braemar Elementary
	Albany, New York 12206	Address:	3600 Mahon Avenue
Phone:	(518) 434-4110		North Van., B.C. V7N 3T6
Supplier:	Saved by Technology	Phone:	(604) 988-6308

Application type: **Music and Graphics**
Version Reviewed: **1.0**
Hardware platform(s): **Macintosh, 512 K, 1 drive, MIDI Interface**
Documentation: **108 page Users' Manual**

Description:

OvalTune turns the Macintosh into a tool for improvisatory graphics and music performance. The user can create graphic patterns and vary the size position and shape using the mouse and the Macintosh keyboard. Melodic sequences can be mapped onto rhythmic patterns with random variations and real-time user control. Users can create "video tape" performances that play on the Mac.

OvaTune enables users to draw using predefined shapes such as ovals, diamonds, rectangles, and lines, or use images imported from other paint programs. Images can be controlled with mouse gestures combined with commands from the Macintosh keyboard.

OvalTune can use a combination of sampled Mac sounds and external MIDI sounds.

Strengths:

- allows students to improvise and to use the computer in new ways;
- fun to use;
- integrates graphics with music;
- musical novices can use and enjoy.

Weaknesses:

- usefulness and potential are inherent, but not immediately obvious;
- does not contain standard MacIntosh paint tools;
- custom grraphics images must be imparted through the scrapbook.

Evaluation Summary:

✓✓✓✓✓=excellent ✓✓✓✓=good ✓✓✓=acceptable ✓✓=poor ✓=unacceptable

Documentation .....✓✓✓✓
Performance .....✓✓✓✓✓
Error Handling.....✓✓✓✓
Ease of Learning and Use ..✓✓✓✓
Overall Value .....✓✓✓✓

Brian's comments on *OvalTune*

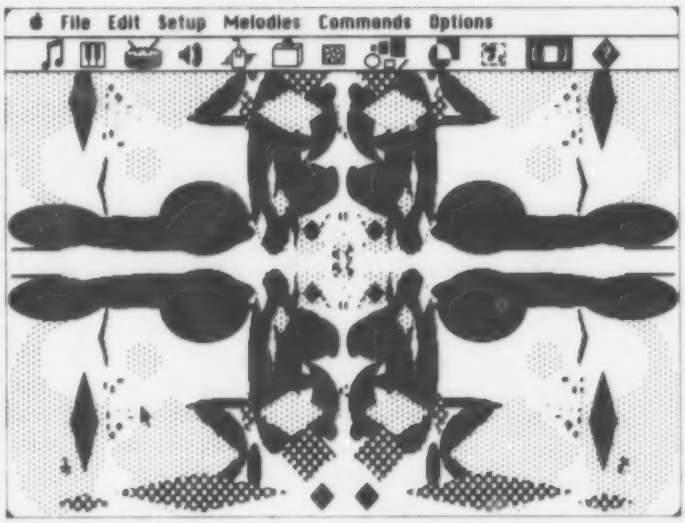
According to Clair Whitmer in *MacWEEK*, *OvalTune* rivals Hypercard as the Macintosh program most difficult to describe. *OvalTune* turns the Macintosh into a performance instrument that allows students to experiment with graphics and sound.

Students can use *OvalTune* with only the Macintosh's sound or connect the computer to a MIDI sound source. The program comes with over one hundred sampled sounds, including a variety of percussion instruments, a few melodic instruments, and a number of effects (including a sampled voice that sounds a lot like Ronald Reagan). Using the sampled Macintosh sounds, the program works best with a second drive so that the libraries of sounds can be easily loaded.

Students can write their own melodies (sequences of pitches) and rhythms. Melodies are entered by clicking on a graphic piano keyboard, or using the Macintosh keyboard. "Rhythms" in *OvalTune* are repeating sequences defined in terms of accents and probabilities. The accent value of a beat determines its volume, using the Mac's internal sounds, or the MIDI key velocity if a MIDI synthesizer is used. A beat's probability value can be set to 100, 75, 50, or 0. A beat with a probability of 100 will always play, a beat with a probability of zero will always be a rest. Melodies can be linked with a rhythm and assigned to a particular instrument.

Students can create and control drum parts, accompaniment parts, and a lead part. An entire configuration of sounds, melodies, and rhythms, along with an accompanying set of graphic elements, can be assigned to a single key of the Macintosh keyboard. Music and graphics can then be triggered by simple keystrokes in a live performance.

OvalTune is not a program that every teacher will feel comfortable with or that every student will take to. In my experience with a class spanning grades 6 to 9, over half of the students seemed to find the program interesting and enjoyable to work with. It was reasonably easy to take them through the various graphics features. The music features, however, required more time to learn.



Because *OvalTune* is so difficult to describe in a short review, teachers should experience it before buying. As one of the first programs to combine graphics and music in a live performance medium, *OvalTune* offers new possibilities for the computer as an interactive instrument. The future will undoubtedly bring new multimedia performance software that builds on the kinds of concepts found in *OvalTune*.

Performer

Author:	Mark of the Unicorn	Evaluator:	Brian Fairholm
Publisher:	Mark of the Unicorn	School District #	44 (North Vancouver)
Address:	222 Third Street	School:	Braemar Elementary
	Cambridge, MA 02142	Address:	3600 Mahon Avenue
Phone:	(617) 576-3066		North Van., B.C. V7N 3T6
Supplier:	Ward Music	Phone:	(604) 98-6308

Application type: **Sequencer**
Version Reviewed: **2.41**
Hardware platform(s): **Macintosh, 512 K**
Documentation: **309 page Users' Manual**

Description:

Performer is a full featured sequencer with a clean, functional appearnce. The normal screen has four windows that can be moved or closed: the Control Panel, the Tracks Window, the Metronome Window and the Counter Window. Other windows can be opened or closed as needed.

Performer has most of the features one would expect from a top-end sequencer. Its editing functions include the usual copy, paste, erase, merge, extensive and flexible quantization, global editing of pitch and velocity. Multiple track looping is possible. Tempo maps and meter maps can be made for complex compositions. Input filtering and view filtering can be used to reduce MIDI clutter.

Performer supports most SMPTE formats. Event editing is only possible in an event list in version 2.41. Graphic editing has been added in version 3.0 (not available at time of this review).

Strengths:

- global editing functions powerful and easy to use;
- clean, uncluttered screen;
- saves standard midi file format;
- exports files to Professional Composer notation software.

Weaknesses:

- user interface does not conform to MacIntosh standards;
- no graphic editing with version 2.41.

Evaluation Summary:

✓✓✓✓✓=excellent ✓✓✓✓=good ✓✓✓=acceptable ✓✓=poor ✓=unacceptable

Documentation .....✓✓✓✓✓
Performance .....✓✓✓✓
Error Handling.....✓✓✓✓
Ease of Learning and Use ..✓✓✓✓✓
Overall Value .....✓✓✓✓

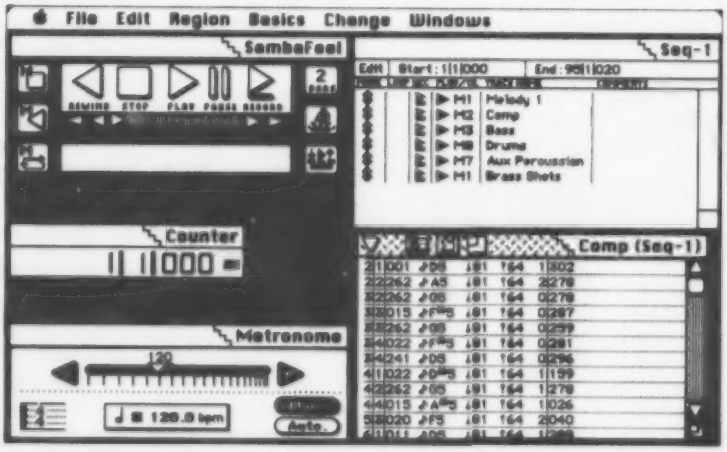
Brian's comments on *Performer*

Performer, by Mark of the Unicorn, is currently the most popular sequencer for the Macintosh computer. The program's visual design is clean and attractive. The screen is divided into functionally distinct windows which can be positioned according to the user's preference. Most of the window controls such buttons, scroll bars, etc. are graphically different from the standard Macintosh controls, although they generally work as expected.

Functionally *Performer* ranks among the more powerful of current sequencers. The quantization functions are comprehensive and flexible. Quantization, like most global editing functions, can be applied to an entire track, or to a selected region of the track. Quantization parameters of *strength* and *sensitivity* can be varied to retain the "human" flavour of the music — this is particularly useful for compositions with a swing feel.

Key velocities can be edited globally with a number of powerful scaling functions including a linear function, two exponential functions and an "S" curve. The user specifies the start and end values for the velocities, and then applies one of the curves to create a carefully controlled crescendo or diminuendo over the selected region of the track.

The major shortcomings of *Performer* are found in its limited representation of the score. Version 2.41 forces the user to edit from an event list, rather than a graphic score. This limitation dates *Performer* with the previous generation of sequencers and puts it far behind Opcode's *Vision*, on the Macintosh, and the new Atari programs such as *C-Lab Notator* and Steinberg's *Cubase*. Version 3.0 of *Performer*, however, includes graphic editing of both note events and MIDI controller data such as pitch-bend and modulation. Unfortunately, version 3.0 was not available at the time of this evaluation.



Performer remains a popular and useful program. Teachers who want a powerful but easy to use sequencer should consider this program as a contender.

Practica Musica

Author:	Jeffrey Evans	Evaluator:	Allan Anderson
Publisher:	ARS Nova	School District #	38 (Richmond)
Address:	P.O. Box 40629	School:	Matthew McNair Sr. Sec.
	Santa Barbara, Calif. 93140	Address:	9500 No. 4 Road
Phone:	(805) 564-2518		Richmond, B.C. V7A 2Y9
Supplier:	Wards, Annex High Tech	Phone:	(604) 274-7258

Application type: Ear Training and Theory
Version Reviewed: 2.16
Hardware platform(s): Macintosh, 1mb, 2 drive
Documentation: 186 page Users' Manual

Description:

Practica Musica is a comprehensive music training tool that uses either built-in sampled sound or a MIDI keyboard. The program instructs a student in ear training for intervals and melody and in the spelling of intervals and chords, including all the chords of standard harmony texts. In melodic or rhythmic dictation, students can work with a melody drawn from a library of historical excerpts or create a new melody with a choice of scale type, key signature and meter. A student either "writes" the pitches in staff notation or enters notes by clicking on the on-screen piano keyboard.

The program can correct the student's work and show correct notation on request. In interval ear training, the program plays an interval, highlights the first note and asks the student to identify the interval by name and to find its other note on the keyboard.

The program saves scores in the manner of a game and can print a progress record anytime.

Strengths:

- excellent program for the Mac that is designed for music education;
- well written text;
- site licence is very reasonable ($350),
- students can keep individual records of progress.

Weaknesses:

- needs further development to include chord ear training, chord progressions, and wrong-note exercises (these topics are being addressed by the developers).

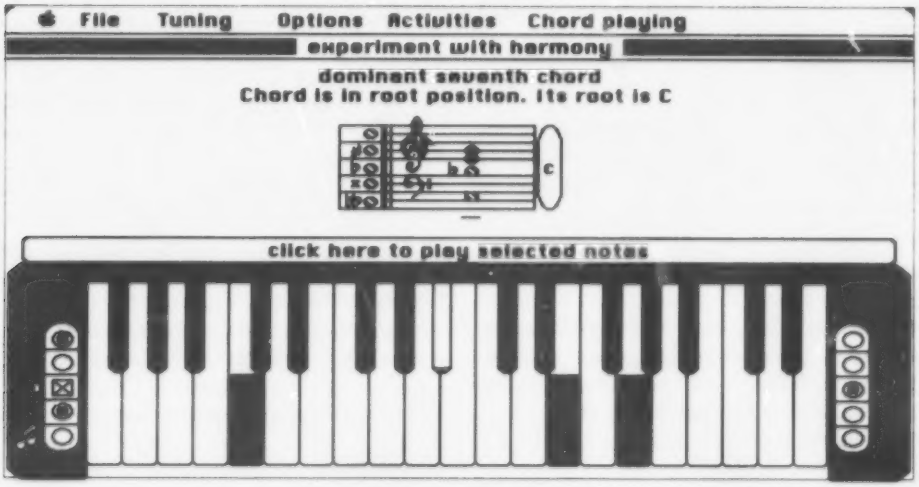
Evaluation Summary:

✓✓✓✓✓-excellent ✓✓✓✓-good ✓✓✓-acceptable ✓✓-poor ✓-unacceptable

Content .....✓✓✓✓
Instructional Quality.....✓✓✓✓✓
Technical Quality .....✓✓✓✓

Allan's comments on *Practica Musica*

Practica Musica is one of the few programs available for the Mac that is designed for the education market. The program was developed for non-major music courses at the University of California at Santa Barbara.



A major strength of this program is that it comes with its own theory text, which is quite good. The program offers activities in visually and aurally identifying pitches, scales, intervals and melodies, as well as chord spelling. Each activity has four levels of difficulty.

Students can keep track of their own progress and print a progress report for the instructor. The report includes not only the levels that the student has achieved, but also the amount of time that they have spent working on it. The reporting option comes only with a class set of the program.

I personally like the flexibility that *Practica Musica* offers. Melodies can be chosen from a library of 40 examples, or randomly generated, or can be created and saved by the teacher. The program is also MIDI compatible, which is very useful in sight-reading exercises where the student is pitted against the clock.

Practica Musica has a number of limitations. It does not include chord progression exercises, chord ear-training, or "wrong-note" exercises (but I have been told that these will be available in the next update). Also, I would like to see a larger range of notes available. At the moment you can only play the notes that are visible on the little keyboard shown on the screen — using the MIDI doesn't by-pass this parameter.

For those of you who, like myself, have been complaining about a lack of educational software for the Mac, I would strongly recommend this program. *Practica Musica* is not copy-protected, and a site license is available at a reasonable price. It is fairly straight forward to learn and, with the textbook, can be a very useful addition to your music classes.

Professional Composer

Author:	Mark of the Unicorn	Evaluator:	Brian Fairholm
Publisher:	Mark of the Unicorn	School District #	44 (North Vancouver)
Address:	222 Third Street	School:	Braemar Elementary
	Cambridge, MA 02142	Address:	3600 Mahon Avenue
Phone:	(617) 576-3066		North Van., B.C. V7N 3T6
Supplier:	Annex Hi-Tech	Phone:	(604) 988-6308

Application type: Transcription/Notation
Version Reviewed: 2.3
Hardware platform(s): Macintosh, 2 drive
Documentation: 167 page Users' Manual

Description:

Professional Composer is a professional quality transcription/notation program for the Macintosh. It will transcribe sequencer files from *Performer* (Mark of the Unicorn) or *Vision* (Opcode) into traditional notation. Scores can be edited within the program or entered graphically.

Professional Composer contains global editing features like copying, cutting, pasting, beaming, diatonic shifting and transposition. The program gives help with range limits of orchestral instruments.

As a notation program, *Professional Composer* is more powerful and flexible than *Deluxe Music Construction Set*, but more awkward to use. With fewer features than *Finale*, *Professional Composer* is easier to learn.

Strengths:

- extensive control of score configuration and print format;
- automatic part extraction;
- supports PostScript;
- reasonably powerful global editing features.

Weaknesses:

- transcription of sequencer files is unnecessarily messy;
- does not play MIDI data;
- will not import or export standard MIDI files.

Evaluation Summary:

✓✓✓✓✓=excellent ✓✓✓✓=good ✓✓✓=acceptable ✓✓=poor ✓=unacceptable

Documentation	✓✓✓✓
Performance	✓✓✓✓
Error Handling	✓✓✓✓
Ease of Learning and Use	✓✓✓✓
Overall Value	✓✓✓✓

Brian's comments on *Professional Composer*

Professional Composer may have a number of applications in a secondary music program. It can be used to print out good quality parts and scores of student compositions or any original or customized arrangements a teacher may need for ensembles. *Professional Composer* will be most useful if used in conjunction with other programs such as the sequencer *Vision*, by Opcode, and *Deluxe Music Construction Set*, by Electronic Arts.

Professional Composer has a few flaws. It is not as easy to learn and use as *DMCS*. It does not have MIDI playing capability, although it has a limited ability to play parts with Mac sounds. The transcription of MIDI sequencer files from *Performer* and *Vision* can often be messy, even when the files have been appropriately quantized. The time necessary to clean up a transcribed file can exceed the time it would take to write it in *DMCS*. Transcriptions in *Finale* and the Atari program *C-Lab Notator*, require far less editing than *Professional Composer* transcriptions.

Professional Composer provides more control over the layout and quality of the printout than *DMCS* and is easier to learn than *Finale*. It may be a useful compromise.

Useful print formatting features include the ability to insert page breaks, print from any page, and place bar numbers above or below the staff. *Professional Composer* also has a number of useful editing features that are missing in *DMCS*. One is a global enharmonic function that changes accidentals to their enharmonic equivalent over an entire selected region. Another is the ability to merge staffs.

One working procedure that I have used is to compose in *DMCS*, then load the file into *Vision*, which has (to its credit) extensive import and export capability. The file can then be saved in *Professional Composer* format, usually requiring very little editing to reach a stage where it can be printed. Although I would not recommend *Professional Composer* by itself, in conjunction with *DMCS* and *Vision*, it can can be useful.

UpBeat

Author:	Ken Offenhart	Evaluator:	Brian Fairholm
Publisher:	Intelligent Music	School District #	44 (North Vancouver)
Address:	116 North Lake Avenue	School:	Braemar Elementary
	Albany, N.Y. 12206	Address:	3600 Mahon Avenue
Phone:	(518) 434-4110		North Van., B.C. V7N 3T6
Supplier:	Annex Hi-Tech	Phone:	(604) 988-6308

Application type: **Rhythm Programmer**
Version Reviewed: **1.2**
Hardware platform(s): **Macintosh, 512K, 2 drive**
Documentation: **54 page Users' Manual**

Description:

UpBeat is a rhythm programmer which can generate rhythmic variations of drum machine and synthesizer patterns The student can enter melodic and rhythmic patterns in real-time or "paint" them in using graphic *MacPaint*-type tools. This program can be useful as a performance tool and as an aid to developing improvisation and learning about rhythm section "feels".

Using *UpBeat*, students can create drum patterns and melodic patterns to be played on a MIDI synthesizer. Patterns can be chained together to create songs. *UpBeat* can generate fills and random variations to provide interest to rhythm parts. Each pattern can contain up to 32 tracks.

Strengths:

- graphic display of rhythmic patterns is clear and easy to understand;
- exports MIDI standard files;
- a useful tool for live performance.

Weaknesses:

- is not a general purpose sequencer;
- narrow range of application.

Evaluation Summary:

✓✓✓✓✓-excellent ✓✓✓✓-good ✓✓✓-acceptable ✓✓-poor ✓-unacceptable

Documentation	✓✓✓
Performance	✓✓✓✓
Error Handling	✓✓✓✓
Ease of Learning and Use	✓✓✓✓
Overall Value	✓✓✓✓

Brian's comments on *UpBeat*

UpBeat is another program by Intelligent Music that fits somewhere in the *algorithmic composition* or *intelligent instrument* category of software. In many ways the program functions as a conventional sequencer, optimized for short 'rhythm section' patterns, and augmented with a few algorithmic composition features.

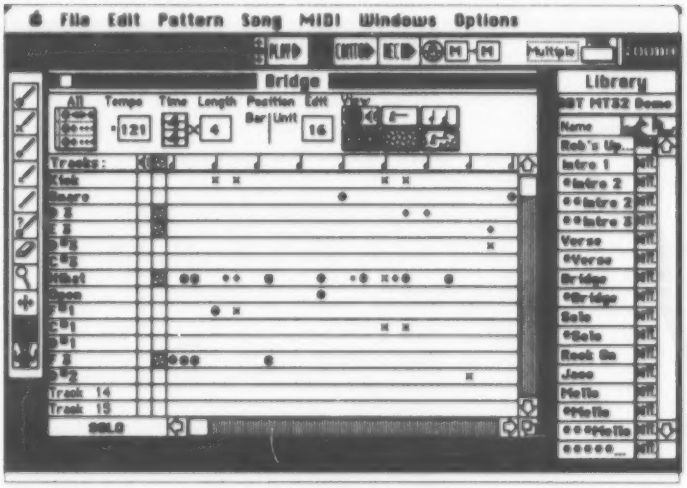
The process of creating patterns is straight forward and easy to learn. The first step is to define a set up, that is, to 'teach' the program what devices and MIDI channels are being used. The set up can be saved for future compositions. To streamline the process for students, a teacher can define the set up and save it in advance.

Once the set up has been defined, the user can choose the tempo, pattern length and time signature, or use the default values, 120 BPM, and 2 measures of 4/4. The real-time entry of notes is controlled from a narrow strip of controls, "Play", "Stop/Continue", and "Record", situated at the top of the screen.

When "Record" is selected, a metronome starts clicking and the program waits for input. It continues cycling through the pattern length, adding layers, or tracks, as they are played. A pattern can contain up to thirty-two tracks. Tracks can be edited to correct awkward rhythms and pitches.

An alternate method of creating patterns involves using a set of tools to "paint" a track, which is really step-time entry with a different face. The two methods can also be combined. One can use the tools to erase or move notes while the pattern is cycling. Together, these methods provide an easy way to experiment with, create and learn about rhythmic feels.

Using the algorithmic composition features of the program, the student sets probability values to determine a track's "density", The program then randomly generates fills. When a track density is set to 100%, its default value, all the notes will be played. If the



density is lowered, the program randomly plays notes from the track in proportion to the density level. At a density of about 90%, the result is a track which varies slightly on each repetition. At lower density levels, the differences between repetitions becomes greater.

Like most of the programs from Intelligent Music, the value of *UpBeat* comes from the unique environment for creating and improvising that it provides. Many of the same things may be accomplished using *Vision*, by Opcode. *UpBeat*, however, is easier to learn and use. *Upbeat* should not be thought of as a replacement for a general purpose sequencer, but as a special tool for live improvisatory performance and the development of contemporary rhythm section feels.

Vision

Author::	D. Oppenheim/R. Spears	Evaluator::	Allan Anderson
Publisher::	Opcode Systems	School District #	38 (Richmond)
Address:	1024 Hamilton Court	School:	Matthew McNair Sr. Sec.
	Menlo Park, CA 94025	Address:	9500 No 4 Road
Phone:	(415) 321-8977		Richmond, B.C. V7A 2Y9
Supplier:		Phone:	(604) 274-7258

Application type: **Music**
Version Reviewed: **3.0**
Hardware platform(s): **Macintosh, 1 meg, 2 drive**
Documentation: **120 page Users' Manual**

Description:

Vision 3.0 by Opcode is a very powerful sequencing program for the Mac. It is very fast and easy to use. The program may be used for professional applications.

Vision Sequencer 3.0 has all of the features of midi Mac 2.5 - 2.6. It also includes such features as graphic editing and list editing of midi events. A midi time code lock with SMPTE numbers displayed on screen, multiple time signatures per sequence system, exclusive data recording, 480th -of-a-quarter-note accuracy, expanded sequence capabilities and other professional features required in the recording industry.

Strengths:

- instruction manual is very readable and well put together;
- a very powerful program , well suited to beginners and advanced;
- windows and graphic editing features are excellent.

Weaknesses:

- for beginning users, the program is not very intuitive; you need the manual.

Evaluation Summary:

*****=excellent ****=good ***=acceptable **=poor *=unacceptable

Documentation	*****
Performance	*****
Error Handling	****
Ease of Learning and Use	****
Overall Value	*****

Allan's comments on *Vision*

In my opinion *Vision* is the premier sequencer available today. For those who wish to use a sequencer as a compositional tool, the program may prove useful for advanced secondary students.

The options are listed in the technical guide, with enough available to keep you busy for many months. This program is not only great to look at; it is designed to allow the maximum musical expression and precision. You can fine-tune your music to perfection with such options as 64th-triplet quantizing and tempo resolution of one hundredth of a beat per minute.

One feature of *Vision* that I really like is the ability to map your MIDI set-up. You can name the MIDI channels and MIDI program numbers according to your own instruments. Because *Vision* uses both of the Macintosh's serial ports, it can record and play back on up to 32 MIDI channels.

Editing in *Vision* can take place in either an event-list window or a graphic "piano roll" score. Note events can be edited quickly and easily. Pitch, attack time and duration can be altered by simply dragging the note in the desired direction. The cursor changes to indicate which parameter you are editing. Pitch bend, modulation and other continuous controller values can be entered and edited graphically.

A *telescope* and a *magnifying glass* can be used to zoom in and out of the graphic score. The screen can display anything from a detailed, blown-up view of a single bar to a bird's eye view of the entire track. A cute "bouncing ball" shows where the beat is when the track is playing. Unfortunately, the display does not scroll with the music.

An interesting feature of *Vision* is its Generated Sequence capability. *Vision* can play a user entered pitch sequence using a variety of pitch and rhythm selection algorithms. The rhythmic character of the generated sequence is controlled by the *rhythm* and *duration* values selected by the user. The pitches can be played in forward, reverse, or alternate directions, or by random selection. The result can be an interesting alternative to purely deterministic composition.

With Opcode's Studio 3 MIDI interface and *Vision*, you can write and read all standard SMPTE formats, and convert them to MIDI Time Code. This makes it possible to synchronize the program to a multitrack tape deck .

Vision can import and export files to Deluxe Music Const*ruction Set*, *Professional Composer*, and any program supporting Standard MIDI File format. With such flexibility of file formats, combined with powerful sequencing features, *Vision* is a very attractive compositional tool for music teachers with access to Macintosh computers.

Education Software Preview Guide

Classroom Technology: Music has attempted to evaluate the most current music software of widespread utility. Many other music programs exist, and some may be worth your attention to suit specific situations and purposes. A thumbnail sketch of 17 of these packages may be found on the next two pages. We have not reviewed these programs ourselves, and their mention in this publication should not be taken as a Ministry recommendation for their use.

The descriptive information about these music software programs is reprinted with permission from the *1988-89 Education Software Preview Guide*. The *Guide* is a publication of the Educational Software Evaluation Consortium of the California State Department of Education, under Bill Honig, Superintendent of Public Education.

This list is intended to help educators locate software that might be appropriate for their applications. It is not an endorsement of the software for purchase without examination.

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The software categories are defined as

DP (Drill and Practice),
CA (Creative Activity),
TU (Tutorial) and
EG (Educational Game).

Title	Publisher	Computers	Grades	Type
Arnold	Temporal	Apple	I2-I7, old 5-10	DP
Drill and Practice of aural skills; music dictation training				
Bank Street Music Writer	Mindscape	C64, IBM	P4 - I4, old 3-7	CA
Create music and print the score				
Concertware+	Great Wave	Mac	I3 - G2, old 6-12	CA
Compose, play, and print music; allows user to customize sounds				
DoReMI	Temporal	Apple	I1 - I5, old 4-8	DP
Develop aural identification of major scales; requires DAC board				
Harmonious Dictator	Temporal	Apple	I5 - G2, old 8-12	DP
Practise recognition of chord progressions ; requires a DAC board				
Jam Session	Broderbund	Mac	I1 - I7, old 4-10	CA
Harmonize a four piece jazz ensemble				
Jazz Dictator	Temporal	Apple	I1 - G2, old 4-12	DP
Practise recognition of chord progressions in a jazz style; requires a DAC board				
Magic Piano	Edusoft	Apple	I1-I5, old 4-8	CA
Create original music; includes two drills on music concepts				
Melodious Dictator	Temporal	Apple	I1 - G2, old 4-12	DP
Develop basic skills of melodic dictation				
Music Detective, The	Temporal	C64, Mac	I1 - I7, old 4-10	TU
Develop perception of note, pitch, and duration; uses standard music notation				
Music Shop	Broderbund	C64,	I1 - I7, old 4-10	CA
Create, play, and print music compositions				
Music Studio	Mediagenic	Apple, C64	P2 - I4, old 1-7	CA
Create, edit, play, and record music on an Apple IIGS; plays MIDI instruments				

Title	Publisher	Computers	Grades	Type
Music Theory	MECC	Apple	I1 - G2, old 4-12	DP
Drill on music terms, notation, rhythms, chords, and scales; contains eighteen programs				
Sir William Wrong-Note	Temporal	Apple	I5 - G2, old 8-12	DP
Recognize errors in a harmonic context of four pat chords				
Songwriter	Mindscape	Apple, C64, IBM	P2 - I4, old 1-7	CA
Compose melodies without using music notation				
Sound Tracks	MECC	Apple	P2 - G2, old 1-12	CA
Compose melodies and experiment with line, shapes, pictures, and colours				
Toney Listens to Music	Temporal	Apple	P2 - I4, old 1-7	DP/EG
Develop discrimination of melodies, intervals, rhythms, and notation; requires a DAC				

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Biographies

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Allan's university training includes a BMus. from the University of British Columbia, and graduate work in administration at Simon Fraser University. At UBC, Allan studied electronic music with Cortland Hultberg and Barry Truax. Allan has extensive experience as a musician. He has played keyboards professionally since he was fifteen and has a national reputation as a director of jazz bands and jazz choirs. He is currently teaching music at McNair Senior Secondary in Richmond, where he is also the district curriculum chairman for music. His music program involves a variety of applications of Macintosh and IBM computers. Allan is also the editor of the *Computers and Technology* department of the BCMEA Journal.

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Robert Turner
Rob has had an interest in computers and music for many years. He studied cmputer music and composition with Barry Truax and Martin Bartlet at Simon Fraser University, where he received a BA in Fine and Performing Arts. He has played keyboards in a variety of professional situations and is currently performing with the Latin-jazz group *Solis*. Rob teaches band and computer music at Forest Grove Elementary in the Burnaby School District. He is also active as a composer of acoustic and electronic music.

Glossary

Acoustic -concerned with the physical characteristics and behaviour of sound.

Additive synthesis -synthesis of a complex sound by adding together sine waves.

After touch -a MIDI message indicating a change in key pressure after the note has been struck. The change in after touch may be used to alter any of a number of parameters -pitch, timbre, vibrato, volume.

Algorithm -a process of rules or steps for computation.

Ambience -the background sound over which a sound is heard; an acoustical environment.

Amplification -increasing the strength of an electrical signal.

Amplitude -the strength of an audio signal, usually associated with loudness.

Analog -a signal or process which operates continuously rather than in discrete steps; a signal or process which is an analogous representation of another, ie, voltage fluctuations of an electrical signal may be an analog of fluctuations of air pressure in a sound.

ASCII -American National Standard Code for Information Interchange. The standard code, using seven-bit coded characters, used to represent alpha-numeric characters in computers, and data communication systems.

Attack -the beginning portion of a sound; the first part of an amplitude envelope.

Audio -related to sound.

Audio frequency -the frequency range which can be heard by human being, usually from 20 to 20,000 Hz.

Audio signal -an electrical signal which represents sound.

Band-pass filter -a filter which reduces the amplitude of all signals outside a specified frequency range or band.

Carrier -an electromagnetic signal which is modulated by another signal, as in frequency modulation (FM) or amplitude modulation (AM).

Channel -a pathway for a signal. Stereophonic sound has two channels, whereas monophonic sound has one. MIDI provides 16 channels through which data may be transmitted and received.

Chorus -an effect created when the original audio signal is mixed with a delayed signal, with a fluctuating delay interval. The result is a "fatter" sound and a sweeping effect as certain harmonics are reinforced, and others cancelled, depending on the delay interval.

Controller -an input device capable of transmitting MIDI data, such as a MIDI keyboard, wind controller, or guitar.

Cue -to locate a particular position in an audio tape or MIDI sequence.

Cut-off frequency -the frequency above which a low-pass filter will reduce the amplitude of the signal, or below which a high-pass filter will reduce the amplitude of the signal.

DAC -Digital to Analog Converter, a device which converts discrete digital data into an analog voltages. A DAC is a necessary component of any digital synthesizer or sampler.

Database -a program which stores information in "fields" on a template in memory. The user may search for a particular field, define a template, organize material alphabetically, etc. *Band Manager* and Microsoft *Works* are such programs.

DCO -Digitally Controlled Oscillator. See oscillator.

Decay -traditionally, the part of an amplitude envelope (ADSR) between the maximum volume of the attack and sustain.

Default -the setting of a parameter automatically assumed by a device or program unless another value is specifically selected.

Digital -a term describing a process or device using numbers to operate.

Digital Delay -an effect caused by mixing a delayed audio signal with the original signal. The delay interval can be controlled in milliseconds, but is usually a fixed interval, rather than variable, as in chorus, phasing, and flanging.

Distortion -the noise created when two audio signal interfere, or when the signal exceeds the capacity of an electrical circuit.

DOS -Disk Operating System, the lowest level of a computer system which handles all input and output.

Dubbing -a recording technique of copying or transferring a track of audio material.

Duration -the length in time of an event.

Dynamics -a musical term for the relative loudness of sounds.

Editing -the process of altering data; with MIDI data, editing may consist of cutting and pasting, altering parameters of individual events, or performing global edits upon entire regions of data.

Electroacoustic -an adjective describing any process involving the transfer of a signal between electrical and acoustic forms.

Envelope -the shape of the amplitude of a signal over time, commonly consisting of an attack, decay, sustain, and release. An envelope may have more or less segments, and may control parameters of a sound other than amplitude, such as pitch or modulation.

Feedback -when a portion of a signal is routed back to itself.

Filter -an electronic device which reduces the amplitude of certain frequencies above or below a cut-off frequency.

Flanging -An effect, similar to phasing, which is caused by mixing a variable delayed signal with the original signal.

Form -the internal organization or structure of music.

Frequency -in acoustics, the rate of repetition of a sound wave, measured in hertz (cycles per second).

Frequency Modulation (FM) synthesis -a method of synthesizing complex sounds by modulating the frequency of one wave (the carrier) with the frequency of another (the modulator). The resulting sound will depend upon a number of variables, including the ratio between the two frequencies, and the depth of modulation.

Fundamental -the lowest frequency of a sound's audio spectrum.

Hard disk -a mass storage device used with computers, typically capable of storing from 20 to several hundred megabytes of data.

Harmonics -frequency components of a complex sound which are multiples of the fundamental frequency.

Hertz (Hz) -the unit of measurement for frequency, cycles per second.

High-pass filter -a filter which reduces the amplitude of frequencies below a cut-off frequency, but allows frequencies above it to pass.

Inharmonics -frequency components, or partials, which are not multiples of the fundamental frequency, and therefore usually sound dissonant.

Initialize -to set to an initial state, to format (a disk).

Input -the signal which goes into a device. With computers, input may come from a number of sources such as the computer keyboard, a mouse or joystick, or a disk, with MIDI instruments, input may come from the keyboard, or the MIDI IN port, or a disk.

Interface -a device or software which allows two distinct devices to communicate.

Key number -the MIDI data which represents the number of key press. Value range from zero to 127. Middle C has a key number of 60.

Key velocity -the MIDI data which represents the velocity with which a key is pressed. The key velocity is most frequently associated with volume, but may be linked to other parameters such as depth of modulation or filtering.

Kilo -thousand, as in kilobyte (1000 bytes) or kilohertz (1000 hz).

LFO -Low Frequency Oscillator, an oscillator in the sub-audio range (below 25 hz), which may be used to control aspects of a sound such as pitch (vibrato), amplitude (tremolo), or the rate of a filter sweep.

Loops -the repetition of a segment of data. In MIDI sequences, loops may occur as repeats in a score, where all tracks are looped together, or, in some cases, individual tracks may be looped independently. In samplers, a loop may be created in the sample data to provide the "sustain" portion of the sound.

Low-pass filter -a filter which reduces the amplitude of frequencies above a cut-off frequency, but allows frequencies below it to pass.

Macro -a command which may consist of a number of actions, assigned to a single key or variable.

Magnetic tape -the standard medium for storage of electronic audio signals; may also be used as a storage medium for digital information, as in tape back-ups for computers, or DAT (digital audio tape) recording.

Master tune -a MIDI command used to set a global tuning variable in MIDI instruments. Individual voices in an instrument may deviate from this setting.

Mega -million, as in megabyte (1,000,000 bytes), or megahertz (1,000,000 hz).

Microtonal -using intervals smaller than a semitone.

MIDI -Musical Instrument Digital Interface, a standard for communication of musical information.

MIDI File Format -a standard file structure for MIDI sequences which allows files to be shared by sequencers made by different manufacturers.

Modulation -a process in which some characteristic of one signal is used to alter another. Common forms of modulation in music are AM (amplitude modulation), FM (frequency modulation) and PCM (pulse code modulation).

Monitor -a device for aural or visual feedback to the user. In computer technology, monitor refers to the visual display device which is part of the human/computer interface. In recording and live performance, a monitor is the component of the sound system which allows performers and technicians to hear the performance.

Mono mode -the MIDI mode in which an instrument will play only one note at a time.

Monophonic -a signal output of only one channel; the ability to play only one note at a time.

Mouse -an input device for computers used to directly manipulate a cursor and graphic objects on a computer screen.

Noise -an unpitched sound consisting of random vibrations; unwanted sound which interferes with a signal.

Note-off -a MIDI command which turns a note off. This command is always followed by a 'key number' and 'key velocity'.

Note-on -a MIDI command which starts a note. This command is always followed by a 'key number' and 'key velocity'.

Omni mode -a MIDI mode in which a device receives on all channels.

Oscillations -periodic vibration of a signal.

Oscillator -a component of a synthesizer or tone generator which produces an audio signal.

Output -the signal which comes out of a device or system.

Overdub -the process of recording one channel at a time.

Pan -to position a signal in a stereophonic mix.

Parameter -generally, a property of something that can be represented by a (numeric) variable. Parameters of sound include frequency, intensity and duration.

Partials -the frequency component of a sound 'spectrum', usually referring to both harmonic and inharmonic overtones.

Patch cord -an electrical chord for connecting audio devices.

PCM -Pulse Code Modulation. A method of encoding digital samples in binary form.

Phasing -An effect, similar to flanging, which is caused by mixing a variable delayed signal with the original signal.

Pitch -the perception of the frequency of a sound.

Pitch bend -a MIDI message which can alter the pitch of a note.

Pixels -"picture elements"; the dots of light which comprise a video display.

Poly mode -the MIDI mode in which an instrument will play polyphonically.

Portamento -an effect of moving smoothly from one pitch to another through small incremental changes of pitch. The time taken to move from one pitch to another can usually be controlled.

Quadraphonic -an audio device with four separate channels of output.

Quantization -rounding a variable to a particular degree of resolution, most frequently referring to the rhythmic resolution of sequencers. For example, if a sequence is quantized so the smallest rhythmic value is an eighth note, all intermediate values will be rounded to the closest eighth note.

Real-time -a term used to describe processes or devices which can handle data as it happens "live"; for example, "real-time" is often used in reference to sequencers to distinguish from step time sequencing in which data is entered one step at a time, rather than in time with a clock.

Receive channel -the MIDI channel to which a device is set to receive data.

Region -an area of a score or sequencer track defined for editing purposes.

Release -the final segment of an ADSR envelope; The release parameter of the envelope determines the time the sound takes to fall to zero from the sustain level, after a key is released.

Resonance -the stimulation of a particular frequency area by an external force of the same frequency. Resonance is a natural acoustic property that can be simulated electronically.

Reverberation (reverb) -the effect caused by rapid reflections and echos of sound due to the acoustic properties of a room or hall; an electronic effect which duplicates acoustic reverberation.

Rhythm -the sense of pulse in sound and music.

Sample -to digitally record a sound by recording at a steady rate, the fluctuation of the waveform; a single entry in a wavetable which represents the amplitude of a sound.

Sample rate -rate at which audio samples are recorded by a sampler. The higher the rate, the better the representation of the sound. High-end samplers may have sample rates as high as 48 or 50 Kilohertz. The highest frequency that can be reproduced by a sampler is less than half the sample rate.

Scaling -the systematic increasing or decreasing of a value, usually referring to a MIDI parameter. For example, the key velocities in a sequence could be scaled upward by 10%.

Score -a graphic or symbolic representation of a musical composition.

Sequence -1. a string of MIDI data including the timing information necessary for it be played. 2. to record MIDI data with a sequencer.

Sequencer -a device or program which can record and play back MIDI data.

Signal -an electrical current which represents acoustic information and can be converted into sound by a loudspeaker.

Signal-to-noise ratio -the ratio between the intensity of the signal to the background noise. A high signal-to-noise ratio is necessary for high fidelity sound.

Sine wave -a simple wave form which contains only a single frequency.

Slave -a device which is linked to and controlled by another device called the "master".

SMPTE -the Society of Motion Picture and Television Engineers.

SMPTE time code -a time code developed by SMPTE to synchronize video and film. SMPTE time code can provide frame by frame autolocation, and synchronization of several video and audio sources.

Spectrum -all the partials (harmonics and inharmonics) that constitute a sound; the graphic representation of the intensity of each of the partials of a sound.

Splicing -the process of cutting and replacing sections of audio tape.

Spreadsheet -a program to do mathematical calculations; the computer equivalent of an accountant's ledger.

Step-time -a term used in sequencing to describe note by note entry of MIDI data where the timing information is manually selected for each note. The term is used to distinguish from 'real-time' entry of data.

Stereophonic -consisting of two audio channels.

Sustain -to maintain a consistent volume; the section of an ADSR envelope at which the sound maintains a consistent volume.

Synthesis -the generation of sound, usually electronically .

Synthesizer -an instrument which synthesizes sound.

System exclusive -a MIDI message which transmits information specific to one manufacturer.

Timbre -the "tone colour" of sound; the specific quality of a sound, other than pitch or volume, which differentiates it from other sounds.

Track -in recording, a discrete recorded audio signal. In MIDI, a track is a sequence of MIDI data, analogous to a tape recorded track.

Transient -a sudden and brief fluctuation in sound such as a scratch in a record or a spike in a power line.

Transmit channel -the MIDI channel to which a device is set to transmit.

Transpose -to alter the pitches of musical data by a consistent interval, putting it into a new key.

Tremolo -an effect caused by the rhythmic fluctuation of amplitude.

V.U. meter -a *volume unit* meter on most tape decks and mixers which indicated the intensity level of the audio signal in decibels.

Vibrato -an effect caused by adding a rhythmic fluctuation of pitch to a sound. The quality of the vibrato can be controlled through its rate and depth.

Volume -the amplitude or loudness of a sound.

Waveform -the shape of one cycle of an audio signal; the visual pattern that sound creates on an oscilloscope.

Window -a rectangular section of the computer screen through which information relating to a particular program or part of a program is displayed.

Bibliography

Books

Title *A Synthesist's Guide to Acoustic Instruments*
Publisher Amsco Publications
Author H. Massey; A. Noyes; D. Shklair
Date 1987
Length 224 pages
Comment A good reference for electro-acoustic arranging. It explains the major types of synthesis, and discusses ranges and acoustic characteristics of common instru ments. It comes with 300 illustrations and a 'floppy' recording of sounds.

Title *Advanced MIDI Applications: Computers, Time Codes and Beyond*
Publisher Alfred Publishing Co
Author Helen Casabona; David Frederick
Date 1987
Length 63 pages
Comment This short text goes beyond most MIDI primers in explaining some of the more advanced applications of MIDI. It would be useful for anyone starting to use SMPTE time code.

Title *Computer-Assisted Music Composition*
Publisher Petercocelli
Author Phil Winsor
Date 1987
Length 330 pages
Comment An overview of the application of computers to music composition.

Title *Computer Music*
Publisher Shirmer Books
Author Charles Dodge; Thomas Jerse
Date 1985
Length 400 pages
Comment An excellent, but technically written account of the use of computers in non-commercial music.

Title *Computer Software in Music and Music Education: a guide*
Publisher The Scarecrow Press, Inc.
Author Barton K. Bartle
Date 1987
Length 252 pages
Comment This is a very comprehensive guide to music software available at the time of publication. It includes extensive descriptions and evaluations.

Title *Electronic and Computer Music*
Publisher Clarendon Press
Author Peter Manning
Date 1985
Length 291 pages
Comment This hardcover book provides a historical overview of electronic music, including classical tape techniques, live performance, and a brief chapter on computer music.

Title *Foundations of Computer Music*
Publisher The MIT Press
Author Curtis Roads; John Strawn (editors)
Date 1985
Length 712 pages
Comment This book is a collection of articles on computer music taken from the *Computer Music Journal*. The level is very technical. Included are topics such as "Grammars as Representations of Music", "Granular Synthesis of Sound", "A Software Approach to Interactive Processing of Musical Sound".

Title *KEYFAX: The definitive guide to electronic keyboards*
Publisher Amsco Publications
Author Julian Colbeck
Date 1985
Length 208 pages
Comment Because the technology is changing so rapidly, this kind of publication is only useful if it is updated frequently. If the publication date indicates it is not a recent edition, you would be better advised to look for current reviews of keyboards in magazines such as *Keyboard* and *Electronic Musician*.

Title *MIDI for Musicians*
Publisher Amsco Publications
Author Craig Anderton
Date 1986
Length 105
Comment This is one of the better introductory level publications on MIDI by the editor of *Electronic Musician*.

Title *MIDI Made Simple*
Publisher Synergetics
Author Joseph Gadoury
Date 1985
Length 106 pages
Comment An introduction to MIDI topics.

Title *Music Machine, The*
Publisher MIT Press
Author Curtis Roads; John Strawn (editors)
Date 1989
Length 725 pages
Comment Selected papers from the *Computer Music Journal* covering a variety of topics related to computer music. Very technical reading.

Title *Music through MIDI*
Publisher Microsoft Press
Author Michael Boom
Date 1987
Length 302 pages
Comment A comprehensive coverage of MIDI.

Title *Musical Applications of Microprocessors*
Publisher Hayden Book Company
Author Chamberlin, Hal
Date 1980
Length 661 pages
Comment This is considered a necessary reference for anyone seriously interested in understanding digital sound processing and synthesis techniques. Although written before MIDI, it contains information that 's still relevant to current syn thesis techniques. The level of writing is very technical.

Title *The Musician's Guide to Home Recording*
Publisher Simon and Schuster Inc.
Author McIan, Peter; Wichman, Larry
Date 1988
Length 313 pages
Comment Secondary teachers who want to set up recording facilities will find this a useful resource. It covers equipment needs, guidelines for configuring a system, and recording techniques.

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Publisher MIT Press, Cambridge, MASS
Editor Curtis Roads
Comment *CMJ* is the most scholarly and technical publication on computers and music. It is aimed at the reader with an interest and background in computers, pro gramming, and 'artistic' as opposed to commercial musical applications.

Title *Electronic Musician*
Publisher Shwartz, D.; Jacob, P.; MIX Publications
Editor Craig Anderton
Comment This magazine contains a variety of information of interest to musicians who use computers and electronic equipment, including software and hardware reviews, interviews, MIDI tutorials, and articles on general applications of computers such as telecommunications and desktop publishing.

Title *Home and Studio Recording*
Publisher Hill, Dennis;Music Maker Publications
Editor Amy Ziffer
Comment Teachers who are interested in recording will find useful information in this magazine. Aimed at the 'recording musician', it contains reviews and tutorials on recording and sound processing equipment, as well as music software.

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Publisher GPI Publications, California
Editor Crocket, JIm
Comment This magazine covers a wide range of topics dealing with music technology, software, current recordings, and performers. Included are regular tutorials on sampling, MIDI programing, patches, as well as product reviews, interviews, and feature articles. Issues are frequently dedicated to a theme such as sam pling, sequencing, notation software etc.

Title *Music & Computers*
Publisher GPI Publications
Editor Dominic Milano
Comment This bi-monthly publication can provide a valuable supplement to the books and monthly magazines about music technology. It frequently contains bibli ographies, and current information about manufacturers and publishers of music related products.

Title *Music Technology*
Publisher Music Maker Publications, Inc.
Editor Bob O'Donnell
Comment *Music Technology* covers many of the same topics as *Keyboard*, but is not as ambitious. Articles are usually well written.